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ABSTRACT

We study the impact of toxic emissions on the migration of corporate executives. We link data on the opening of industrial plants emitting toxic air pollutants with information on the career paths of executives at all S&P 1500 firms over the 1996-2014 period. We find that (1) the opening of toxic emitting plants increases the rate at which executives leave geographically close firms and move to firms in less polluted areas, (2) stock returns fall when these "treated" executives announce their departures, and (3) the replacement executives have less experience than the departing executives.

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1. Introduction

Pollution imposes costly externalities. It harms health, increasing infant mortality, neurodevelopmental disorders, respiratory and cardiovascular disease, cancer, etc.[1] Indeed, the World Health Organization (WHO) attributes about one in six deaths in 2012 to air pollution. According to the American Lung Association's State of the Air 2017 report, more than 40% of the people living in the United States live in counties that have unhealthful levels of air pollution. A growing body of related research finds that pollution lowers housing prices and reduces labor productivity (e.g., Chay and Greenstone 2005, Greenstone and Gallagher 2008, Currie, Davis, Greenstone and Walker 2015, and Zivin and Neidell 2012). Consequently, researchers examine the benefits of environmental protection regulations and the costs of those regulations on economic activity and business profitability (e.g., Becker and Henderson 2000, Greenstone 2002, Auffhammer and Kellogg 2011, Walker 2013, Greenstone, Hornbeck and Moretti 2010).

In this paper, we examine an additional externality: The migration of corporate executives from firms that are geographically close to polluting plants. Given that toxic pollutants have adverse health effects, a polluting plant could make it more difficult for geographically close firms to attract and retain individuals who have employment options in less polluted areas. We focus on executives because (1) executives exert a significant impact on corporate policies (e.g., Graham et al., 2013; Schwartz-Ziv and Weisbach, 2015, and Pan, Wang, and Weisbach, 2016) and (2) we can trace the career paths of executives over time and across corporations. Thus, we ask: When a plant starts emitting toxic pollutants, does this trigger executives in neighboring firms to leave and migrate to areas with less pollution, do these executive departures affect firm value, and what are the comparative professional experiences and compensation packages of the replacement executives? By linking environmental economics with corporate finance, we provide additional evidence on the effects of pollution on the economy.

[1] An enormous literature studies the health effects of pollution. The Environmental Protection Agency, American Lung Association, Center for Disease Control, National Institute of Health's Environmental Health Sciences group, and WHO regularly summarize medical research on pollution and health. Economic research also discovers that pollution has adverse health effects (e.g., Chay and Greenstone 2003, Currie and Neidell 2005, Knittel, Miller and Sanders 2016, Schlenker and Walker 2016, IIsen, Rossin-Slater, and Walker 2017).

To evaluate the impact of pollution on executive migration, we combine several datasets on toxic emissions and create a unique database on the career paths of executives. First, we assemble data on the career paths and compensation packages for all executives at S&P 1500 firms over the period from 1996 through 2014 from BoardEx and ExecuComp. Thus, we know where executives work, when they depart, and to which firms they migrate. Second, we identify plants that emit airborne toxic pollutants using the Environmental Protection Agency's (EPA's) Toxic Release Inventory (TRI) program. Since 1986, the Emergency Planning, Community Right to Know Act (EPCRA) requires that plants in particular industries that use specific toxic chemicals in sufficient quantities and that have ten or more full-time equivalent employees must report the emissions of those TRI-listed toxins. Third, to obtain precise information on the opening years and addresses of these TRI-plants, we match data from the EPA's TRI program to the National Establishment Time-Series (NETS) data, which contains detailed data on the universe of U.S. establishments (over 58.8 million establishments) during the past two decades. The matched sample yields 48,317 TRI plants and their opening dates. Fourth, we use EPA data from outdoor pollution monitors on the concentration of airborne pollutants. We use these data on airborne pollutants to show that TRI plant openings are associated with a material increase in air pollution close to those new TRI plants.

The key challenge to identifying the impact of toxic emissions on executive migration is omitted variable bias. An omitted factor could account for both toxic emissions and executive migration, potentially leading to spurious inferences about the relationship between pollution and executive migration. We use three empirical strategies to address this concern. First, rather than examining the relationship between pollution levels and executive turnover in a locality, we follow Currie, Davis, Greenstone and Walker (2015) and examine the impact of TRI plant openings. While they examine the impact of TRI plant openings on housing prices, we evaluate the impact of these openings on the percentage of executives who leave geographically close firms. In these analyses, the dependent variable is the percentage of executives who separate from an S&P 1500 firm in a year (or in two years). The main explanatory variable is an indicator of the degree to which the S&P 1500 firm is exposed to

TRI plant openings. To measure exposure, we use indicators of the number of TRI plant openings within a two (or five) mile radius of an S&P 1500 firm. In robustness tests, we weight these openings by the inverse distance between the TRI plant and the S&P 1500 firm. Critically, the regressions control for Metropolitan Statistical Area (MSA)-time effects, so that we are comparing S&P 1500 firms within the same MSA and year that are differentially exposed to TRI plant openings. Thus, we account for all local economy factors, where the local economy is defined as an MSA. The regressions also control for industry-year fixed effects since industries might concentrate geographically and have distinct pollution and executive migration tendencies. Finally, the regressions include firm fixed effects and time-varying firm traits, e.g., firm size, growth, leverage, and cash-flow volatility.

Second, we examine individual executives and assess whether an executive is more likely to separate from a firm with greater exposure to TRI plant openings. To conduct this assessment, we use a linear probability model where the dependent variable is an indicator variable that equals one if the executive leaves the firm during the next year (or two). The main explanatory variable is again a measure of firm exposure to TRI plant openings. In addition to including all of the control variables employed in the firm-year analyses, these individual-level analyses also control for individual fixed effects as well as the executive's age and tenure with the firm. Moving to individual-year analyses focuses on the separation experiences of individual executives, rather than on the more aggregate firm-level analyses, and allows us to condition out all time-invariant executive traits.

Third, we extend the baseline individual-level analyses to address additional identification concerns. We do this by differentiating executives by their human capital traits and evaluating whether their responses to TRI plant opening vary in a theoretically predictable manner. Specifically, executives with greater general human capital skills that have comparatively appealing employment options in less polluted areas should be more likely to separate from firms exposed to TRI plant openings than executives with more firm-specific human capital skills and comparatively less appealing outside options. To evaluate this hypothesis, we use Custodio, Ferreira, and Matos's (2013) measure of the degree to which an executive's skills are transferrable across firms and industries and test whether there is a larger increase turnover among executives with more general human capital skills when their firms are exposed to TRI plant openings. By examining whether executives with different human capital skills within the same firm respond differently to the same TRI plant openings, we reduce concerns that an omitted variable is biasing our results, as any such variable would also have to account for this differential response.

We find that exposure to TRI plant openings is associated with a sharp increase in executive migration. The firm-level analyses indicate that TRI plant openings are associated with a material increase the percentage of executives who leave neighboring S&P 1500 firms. For example, the estimates indicate that if one TRI plant opens within two miles of an S&P 1500 firm, the proportion of executives who leave during the next two years rises by 1.55%, which is large since only 22% of executives leave the average firm over each two-year period. The individual-level analyses confirm this finding: executives are more likely to leave their firms when a TRI plant opens close to them. Our estimates indicate that if one TRI plant opens within two miles of an executive's firm, this is associated with a 2.6% increase in the probability that the executive leaves the firm within two years. Furthermore, the evidence is consistent with the view that executives with more general human capital skills are more likely to separate from firms exposed to TRI plan openings than executives with more firm-specific human capital.

We next extend the results along three dimensions to shed additional light on the mechanisms linking pollution and executive migration. First, one interpretation of our findings is that TRI plant openings increase pollution and this pollution prompts executives to leave; that is, these executive separations are triggered by pollution, not by poor executive performance. This interpretation implies that executive departures from firms exposed to TRI plant openings should reduce the stock prices of those firms. This is what we find. Firms' cumulative abnormal returns fall markedly when executives announce their departures following geographical close TRI plant openings. Second, the view that toxic emissions encourage executive migration also has predictions about the replacement executives. If pollution makes a locality a less appealing place to work, then firms will find it difficult to attract replacement executives with comparable qualifications, at comparable compensation rates. Consistent with this prediction, we find that replacement executives have less executive experience, were less likely to have previously served as the chair of the board of directors, were less likely to have been a CEO, and receive much lower compensation than the departing executives. Third, if executives leave S&P 1500 firms because of pollution, then we should observe these executives moving to firms in less polluted areas. We confirm this prediction: Executives who leave S&P 1500 firms after TRI plant openings systematically move to firms in less polluted locals.

This research relates to the broad literature on the degree to which people "vote with their feet" (e.g., Tiebout, 1956; Epple and Sieg, 1999; Banzhaf and Walsh, 2008). For example, Moretti and Wilson (2017) show that U.S. state corporate taxes shape the migration patterns of star scientists, while Kleven, Landais, and Saez (2013), Kleven, Landais, Saez, and Schultz (2014), and Akcigit, Baslandze, and Stantcheva (2016) examine the international migration of highly skilled individuals in response to differences in personal income tax rates. In our paper, we quantify the sensitivity of the migration of corporate executives to TRI plant openings that emit toxic air pollutants. In this way, we contribute to research on the locational choices of high human capital individuals.

Our research also contributes to a large literature on the executive labor market and the causes and consequences of executive turnover. An extensive body of research examines the factors inducing firms to replace executives, the executive labor market and the impact of voluntary and involuntary executive turnover on corporate performance (e.g., Denis and Denis, 1995; Hermalin and Weisbach 1988; Warner, Watts, and Wruck, 1988; Weisbach, 1988, 1995; Harford, 2003; Gabaix and Landier, 2008; Harford and Schonlau, 2013). We examine a particular motivation for an executive to voluntarily leave a firm: an increase in pollution from neighboring firms. We show that the resultant executive turnover has a material adverse effect on stock returns.

Finally, our work relates to research on the political economy of environment regulation. As noted above, an extensive body of research examines the effectiveness of regulations in reducing pollution, the economic benefits of reducing pollution, and the economic costs of environmental regulations. Research also explores how different interest groups shape environment policies (e.g., Baumol and Oates, 1988; Oates and Portney, 2003). Our results indicate that corporations exposed to the toxic emissions of other plants experience costs in terms of the migration of high human capital individuals and stock price reductions. These costs could factor into cost-benefit assessments of environmental regulations.

The remainder of this paper proceeds as follows. Section 2 provides details on the sources and construction of the dataset. Section 3 presents the core results on the impact of exposure to TRI plant openings on executive migration. Section 4 extends the analyses to examine the mechanisms linking TRI plant openings and executive migration and section 5 concludes.

2. Data, Variable Construction, and Descriptive Analyses

2.1. Toxics Release Inventory (TRI) Plants, Pollution Monitors, and NETS Data

The Environmental Protection Agency's (EPA's) Toxic Release Inventory (TRI) program mandates that all U.S. plants that meet specific criteria must report how much of each toxic chemical they "release," i.e., emit into the air, water, or soil, in each year. Specifically, the EPA mandates that any plant that (1) manufactures, processes, or otherwise uses a TRI-listed chemical in quantities above threshold levels in a given year, (2) has 10 or more full-time equivalent employees, and (3) is in the mining, utility, manufacturing, publishing, hazardous waste, or federal industry must report the emissions of each TRI-listed toxic chemical. The TRI program makes this information publicly available, along with the latitude and longitude of each TRI plant.

To determine the year when a TRI plant opened, we must augment these EPA data. In particular, a plant enters the TRI database in the year that it meets all three criteria mentioned above. However, a plant could be emitting toxic pollutants for several years before it enters the TRI database but only enters the TRI database when it has 10 employees or when EPA changes the list of chemicals that it uses to define TRI plants. Thus, to establish the year when the TRI plant began operations, we merge the EPA's TRI database with the National Establishment Time-Series (NETS) data. NETS provides data on U.S. plants and their parent companies, including the year when each plant was established, the geographic location of each plant, as well as data on sales, number of employees, ownership, etc. The NETS dataset has information on over 58.8 million U.S. establishment-year observations during the past two decades. The matched TRI-NETS dataset allows us to infer the opening year of each TRI plant.[2]

The EPA also provides annual data on pollutant density as recorded by each of its air monitors. A single air monitor records the density of multiple pollutants at a fixed location every hour. We compute the average hourly density of each pollutant at each monitor over each year. These monitors have the capacity to record 894 different pollutants, but every monitor does not record every pollutant in every year. Therefore, we examine the most heavily monitored pollutants. Specifically, we sort the pollutants by how often they are monitored across all monitor-year observations and select the top 10 pollutants: PM10 Total 0-10um STP (STP: standard temperature and pressure), Suspended Particulate (TSP: total suspended particulates), Carbon monoxide, Ozone, Lead (TSP) STP, Sulfur dioxide, Benzene, Toluene, PM10 – LC (LC: local conditions), and Ethylbenzene. The EPA provides the latitude and longitude of each monitor.

2.2. S&P 1500 Firms

We examine all S&P 1500 firms, as listed in Standard & Poor's. We construct the following firm-level characteristics from Compustat data: *Total Assets, Leverage* (liabilities/total assets), *Operating Cash Flow / Total Assets, Sales Growth, Cash Flow Volatility* (standard deviation of cash flows during the last five years). We identify the historical address of each firm's headquarters using several databases. We start from the database compiled by McDonald and Yun, who have parsed all of the fields appearing in headers for 10-K forms (available on the SEC's EDGAR website) to determine the precise historical location of listed firm's headquarters.[3] For firms that are not in the McDonald and

[2] There might be concerns that a plant was operating for several years and only started emitting toxic pollutants in the year that it entered the TRI program. In this case, it would be inappropriate to use date from NETS when the plant was first established. Consequently, we have conducted all of the analyses using the date when a plant first appears in the TRI database and obtain very similar parameter estimates and p-values.
[3] https://www3.nd.edu/~mcdonald/10-K_Headers/10-K_Headers.html

Yun database, we use the Compustat Snapshot database and WRDS SEC Analytics Suite to determine historical locations. Because the SEC did not require electronic filing that contains headquarters addresses until May 1996, our sample starts then. From the street address of each firm's headquarters, we compute its longitudinal and latitudinal coordinates.

We obtain data on executives in each S&P 1500 firm in each year from BoardEx and ExecuComp. By comparing the lists in successive years, we identify those executives who leave and join firms. We also collect information on each executive over time, including age, experience, tenure in each firm, positions in the firm (e.g., CEO, chair of the board), compensation, etc. Thus, we trace out the career paths of each executive over time and across S&P 1500 firms.

2.3. TRI Plant Openings Near S&P Firms

We construct and examine three time-varying measures of the exposure of S&P 1500 firms to toxins emitted by the opening of TRI plants. First, *# of TRI Plants Opened within 2* $Miles_{f,t}$ equals the number of TRI plant openings within two miles of S&P1500 firm *f* in year *t*. Second, *# of TRI Plants Opened within 5* $Miles_{f,t}$ equals the number of TRI plant openings within five miles of S&P 1500 firm *f* in year *t*. Third, *Distance-Weighted # of TRI Plants* $Opened_{f,t}$ is a distance-weighted measure of TRI plant opening within five miles of S&P1500 firm *f* in year *t*. In particular, this measure weights each newly-opened TRI plant in a given year within five miles of an S&P 1500 firm by the inverse of the distance (in miles) between the TRI plant and the S&P 1500 firm. For example, if in a given year, an S&P 1500 firm has TRI plants open 1.5 miles, 1.7 miles, and 3.5 miles away, then the firm's *Distance-Weighted # of TRI Plants Opened* in that year is 1/1.5+1/1.7+1/3.5 = 1.54. This weighting helps account for the likelihood that air pollution dissipates with distance from the TRI plant emitting the toxic air pollutants.

2.4.Descriptive Information

Table 1 provides detailed variable definitions, Table 2 gives summary statistics, and Figure 1 illustrates the distribution of TRI plants across the United States. It includes plants that opened at some point since 1996. Plants are largely distributed in the New York, Boston, Chicago, and Detroit metropolitan areas. Other areas with a high density of plants include Atlanta, Charlotte, Minneapolis, Salt Lake City, Phoenix, Denver, Houston, Dallas, Seattle, Portland, San Francisco, Los Angeles, Tampa, and Orlando. There are approximately 2,000 – 4,000 openings and closings each year. The total number of plants remains relatively stable at between 22,000 and 25,000, with no clear trend over time.

3. Empirical Results

3.1. Effect of TRI Plant Openings on Major Pollutants

Before assessing the impact of TRI plant openings on the separation of executives from geographically close S&P 1500 firms, we first evaluate whether TRI plant openings are associated with increases in air pollution near those plants. We examine the density (in nanograms/m^3) of each pollutant at air monitors close to each TRI plant. Specifically, for each monitor in each year, we identify all TRI plant locations within five miles. For each of these monitor-plant pairs in each year, we assign the density of the pollutants recorded by the relevant air monitor, so that we have multiple observations for each TRI plant in a year when there are more than one monitor within five miles of the plant. If two TRI plants are within five miles of the same monitor, we assign each of these monitor-plant pairs the same pollutant density. Thus, we define $p_{m,l,t}$ as the density of pollutant p measured at monitor m that is within five miles of plant l in year t. Our main explanatory variable, $Dummy(Plant\ is\ Operating)_{l,t}$ is a dummy variable that equals zero in the years before a TRI plant opens and one afterwards. The regressions also control for year fixed effects (δ_t) and monitor-plant fixed effects ($\delta_{m,l}$), so that

$$p_{m,l,t} = \alpha + \beta Dummy(Plant\ is\ Operating)_{l,t} + \delta_t + \delta_{m,l} + \varepsilon_{m,l,t}, \tag{1}$$

where α is a constant, $\varepsilon_{m,l,t}$ is the error term, and the estimated value of β provides information on the impact of a TRI plant opening on pollution levels at monitors within five miles of the plant. Table 3 reports the results of ten regressions, one for each pollutant.

Table 3 shows that TRI plant openings induce a significant increase in all of the ten pollutants. The last column of Table 3 provides information on the economic magnitudes of the estimated coefficient on $Dummy(Plant\ is\ Operating)$ for each pollutant by computing the estimated change in the pollutant as a percentage of the pollutant's average across all monitors in the country. For example, when examining the toxin *Lead*, the estimated coefficients indicate that a TRI plant opening is associated with an increase of 7.75 nanograms/m^3 of lead in the air, which is 18.3% of the mean density of lead recorded by an average monitor.

3.2. TRI Plant Openings and Executives Migration: Firm-year Analyses

We next examine the relationship between TRI plant openings and the percentage of executives who leave neighboring S&P 1500 firms. For brevity, we refer to S&P 1500 firms as "firms," and use the designator "*f*." The dependent variable in these firm-year regressions is either (1) $E^1_{f,t}$: the percentage of executives who leave firm *f* during year *t*, (i.e., the number of executives who leave the S&P 1500 firm between the end of year *t-1* and the end of year *t* divided by the total number of executives in that firm, *f*, at the end of year *t-1*) or (2) $E^2_{f,t}$: the percentage of executives who leave firm *f* during years *t* and *t+1* (i.e., the number of executives who leave the firm during the two years between the end of *t-1* and the end of *t+1* divided by the total number of executives in *f* at the end of year *t-1*).

Thus, we estimate the following regression:

$$E^z_{f,t} = \alpha + \gamma TRI\ Plant\ Openings_{f,t} + \theta \boldsymbol{X}_{f,t} + \delta_{MSA,t} + \delta_{k,t} + \delta_f + \epsilon_{f,t}, \qquad (2)$$

where the dependent variable is either $E^1_{f,t}$ or $E^2_{f,t}$, and *TRI Plant Openings*$_{f,t}$ is one of the three time-varying measures of the exposure of S&P1500 firms to toxins emitted by the opening of TRI plants: *# of TRI Plants Opened within 2 Miles*$_{f,t}$, *# of TRI Plants Opened within 5 Miles*$_{f,t}$, or *Distance-Weighted # of TRI Plants Opened*$_{f,t}$. $\boldsymbol{X}_{f,t}$ represents the following characteristics of S&P 1500 firm f in year t: *Total Assets, Leverage, Operating Cash Flow / Total Assets Ratio, Sales Growth*, and *Cash Flow Volatility*. We conduct the analyses while excluding and including these time-varying firm traits. All regressions also control for MSA-year ($\delta_{MSA,t}$), industry-year ($\delta_{k,t}$), and firm δ_f fixed effects, where we use the Metropolitan Statistical Area (MSA) and the industry (k) of firm f. Standard errors are clustered at the MSA level.

This specification addresses three potential concerns with identifying the impact of TRI plant openings on the proportion of executives who depart from firms geographically close to the toxic emitters. First, there might be concerns that (a) firms choose to open toxic emitting plants in economically depressed localities and (b) executives are more likely to separate from firms in economically declining areas, so that any relationship between TRI plant openings and executive migration reflects something about local economic conditions and not the causal effect of TRI plant openings on executive separation decisions. Thus, we control for MSA-year fixed effects. By including MSA-year effects, we compare S&P 1500 firms within the same MSA and year that are differentially exposed to TRI plant openings. Second, there might be concerns that time-varying industry characteristics explain both the increases of executive turnover and pollution. If particular industries congregate geographically and have different distinct pollution and executive turnover patterns, then this could impede our ability to draw inferences about the impact of TRI plant openings on executive migration. Although MSA-year fixed effects will help address this concern, industries might congregate geographically even within MSAs. Thus, we control for industry-year fixed effects to further reduce concerns that omitted factors, e.g., time-varying industry characteristics, create a spurious correlation between TRI plant openings and executive migration. Third, firm-specific characteristics might affect the self-selection of executives out of particular geographical areas. To condition out all time-invariant firm effects, we control for firm fixed effects.

Table 4 shows that TRI plant openings are associated with an economically large increase in the percentage of executives who leave S&P 1500 firms close to the new TRI plants. Across all specifications, each of the three measures of $TRI\ Plant\ Openings$ enters positively and significantly. This holds when the dependent variable is either the proportion of executives who leave the firm during year t ($E^1_{f,t}$) or the proportion of executives who leave during year t and $t+1$ ($E^2_{f,t}$). Furthermore, the results are robust to excluding or including the time-varying firm characteristics and the estimated coefficients on the $TRI\ Plant\ Openings$ variables change little when conditioning on firm traits. The estimated coefficients are economically meaningful. For example, using regression (11), if one TRI plant opens within two miles of an S&P 1500 firm, the proportion of executives who leave during the next two years rises by 1.55%, where 22.6% of executives leave the average firm every two years.

3.3. TRI Plant Openings and Executives Migration: Individual-year Analyses

To provide more information on the relationship between TRI plant openings and executive departures from neighboring firms and to address additional identification concerns, we turn our focus from the proportion of executives leaving firms and instead trace the decisions of individual executives over time. In these individual-year analyses, we evaluate the change in the probability that an executive leaves an S&P 1500 firm when a TRI plant opens nearby. By studying individuals rather than the group of executives at firms, we control for all time-invariant and several time-varying traits of each executive.

In these regressions, the dependent variable is either $L^1_{i,f,t}$, which equals one if executive *i* leaves firm *f* in year *t*, and zero otherwise, or $L^2_{i,f,t}$, which equals one if executive *i* leaves firm *f* during year *t* or *t+1*, and zero otherwise. As above, we separately examine the exposure of firm *f* to TRI plants in year *t* (*TRI Plant Openings*$_{f,t}$) using three measures: *Distance-Weighted # of TRI Plants Opened*, *# of TRI Plants Opened within 2 miles*, and *# of TRI Plants Opened within 5 miles*. Furthermore, the regressions control for the time-varying S&P 1500 firm characteristics discussed above ($\boldsymbol{X}_{f,t}$), as well as two characteristics of each executive ($\boldsymbol{C}_{i,f,t}$), *Tenure* and *Age*, that might independently influence the rate of separation between the executive and firm. We provide the results with and without $\boldsymbol{X}_{f,t}$ and $\boldsymbol{C}_{i,f,t}$.

Thus, we estimate the following linear probability models:

$$L^{z}_{i,f,t}, = \alpha + \gamma TRI\ Plant\ Openings_{f,t} + \theta \boldsymbol{X}_{f,t} + \lambda \boldsymbol{C}_{i,f,t} + \delta_{MSA,t} + \delta_{k,t} + \delta_{i} + \epsilon_{i,f,t}, \quad (3)$$

where the dependent variable is $L^{1}_{i,f,t}$ or $L^{2}_{i,f,t}$. All regressions include MSA-year ($\delta_{MSA,t}$), industry-year ($\delta_{k,t}$), and individual (δ_{i}) fixed effects, where we use the MSA and industry (*k*) of the S&P 1500 firm (*f*) in which individual *i* is an executive. The regressions are estimated using OLS, and standard errors are clustered at the MSA level.

Consistent with the firm-level analyses, the results from the individual-level analyses reported in Table 5 indicate that executives are more likely to leave their firms when a TRI plant opens close to them. Each of the three measures of $TRI\ Plant\ Openings$ enters positively and significantly. These results hold when examining either the indicator of whether the executive leaves during the year that the TRI plant opens or the indicator of whether the executive leaves in the two years following the TRI plant opening. With respect to the economic sizes of the estimated coefficients, consider the impact of one TRI plant opening within two miles of an executive's firm. The results reported in regression (11) indicate that this is associated with a 2.6% increase in the probability that the executive leaves the firm within two years, where 18% of executives leave every two years in the average firm.

3.4. Differentiating by Generalist and Specialist Executives

We next assess whether executives with different human capital skills respond differently to TRI plant openings. We hypothesize that when TRI plant openings increase toxic air pollutants, executives at nearby firms who have skills that are in stronger demand at other firms will be more likely to relocate than executives with more firm-specific skills. This hypothesis predicts that when executives are "treated" with air pollution, the executives with more general human capital will be more likely to leave the firm than executives with more firm-specific human capital.

To evaluate this hypothesis, we examine the degree to which CEOs have general human capital skills, i.e., skills that are valued highly at other firms. We use the *Generalist*

CEO Index constructed and analyzed by Custodio, Ferreira, and Matos (2013) that gauges the extent to which a CEO's skills are transferrable across firms and industries. The *Generalist CEO Index* varies over time for each individual and reflects information on the numbers of past positions, firms, and industries and whether the executive was a CEO in the past and the complexity of the organizations in which the CEO was employed. We then test whether there is a larger increase in the rate of departures of CEOs with more general human capital skills when a TRI plants opens nearby.

The regression specification and estimation procedures are the same as in equation (3) except that we add an interaction term between *TRI Plant Openings* and *Generalist CEO Index*. Specifically, we estimate the following equation:

$$
\begin{aligned}
L^{z}_{i,f,t'} = \alpha + \beta TRI\ Plant\ Openings_{f,t} * Generalist\ CEO\ Index_{i,t} \\
+ \phi Generalist\ CEO\ Index_{i,t} \\
+\gamma TRI\ Plant\ Openings_{f,t} + \theta \boldsymbol{X}_{f,t} + \lambda \boldsymbol{C}_{i,f,t} + \delta_{MSA,t} + \delta_{k,t} + \delta_{i} + \epsilon_{i,f,t}, \quad (4)
\end{aligned}
$$

where the variables are defined as above. If $\beta > 0$, then this would suggest that CEO departures are more likely in response to a TRI plant opening when the CEO has more general, and hence more transferable, skills.

As shown in Table 6, the evidence is consistent with the view that when firms are exposed to air pollution from the opening of a TRI plant, executives with more general human capital skills leave firms more frequently during the next years than executives with more firm-specific skills. These results are reported in regressions (7) – (12) of Table 6. The estimated coefficient on the interaction term between *TRI Plant Openings* and *Generalist CEO Index* enters positively and significantly for each of the three *TRI Plant Openings* measures and these findings are robust to including or excluding the time-varying firm and individual controls. The estimated economic effects are large. For example, compare two CEOs running exactly the same S&P 1500 firm, one at the 25$^{\text{th}}$ percentile of the distribution of the *Generalist CEO Index* (-0.79) and the other at the 75$^{\text{th}}$ percentile of distribution (0.46). The results from regression (11) indicate that the opening of a TRI plant within two miles of these CEOs would increase the probability of the CEO at the 75$^{\text{th}}$ percentile of leaving the firm by 4.5% more than the CEO at the 25th percentile of the *Generalist CEO Index* distribution, i.e., 4.5% = 0.036*(0.46 – (-0.79)). By differentiating executives by human capital and showing that they respond in a theoretically predictable manner to the same pollution shock, we reduce concerns that the findings on executive migration are driven by an omitted factor that simultaneously increases pollution and executive migration in an MSA.

4. Extensions

We now extend the results by examining three additional implications of the view that TRI plant openings increase toxic emissions that induce executives at neighboring firms to leave. We explain each implication and then provide an empirical evaluation of the predicted relationship.

4.1. CARs around Executives' Turnover Announcement

First, if there are costs associated with replacing well-performing executives (e.g., Gabaix and Landier 2008) and air pollution triggers the departure of executives in general, and not poorly-performing executives in particular, then air pollution induced migration will tend to reduce the firm's stock price. That is, if air pollution is causing an otherwise sound executive to leave a firm, this is likely to have an adverse effect on the firm as suggested by the work of Warner, Watts, and Wruck (1988) and Denis and Denis (1995).

To evaluate this first implication, we examine the relationship between the announcement date of executive departures and their firm's cumulative abnormal returns (CARs). We obtain the announcement date of each executive from ExecuComp and crosscheck these dates with 8-K filings. To compute the CARs, we use security prices from the Center for Research in Security Prices (CRSP) database. We examine CARs over the 5-day window from two days before until two days after the announcement day. Setting the announcement day as day 0, the CAR window is therefore indicated as (-2, +2). We use three standard models to compute abnormal returns. The 1-factor abnormal return is computed as the firm's return minus the market index return. Following Brown and Warner (1985), we define 3-factor and 4-factor abnormal returns by using the difference between actual and projected returns. To compute projected returns, we (1) regress the firm's daily return on the value-weighted returns on the CRSP equally weighted market portfolio over the 200-day period from the 210th trading day through the 11th trading day before the announcement date of each deal and (2) use the estimated parameters to compute the projected returns during the 5-day event window (-2, +2). For the 3-factor model, we use the Fama-French benchmark factors of Rm-Rf, SMB, and HML as regressors, where Rm-Rf is the value-weighted market return minus the one-month Treasury bill rate, SMB (Small Minus Big) is the average return on three small portfolios minus the average return on three big portfolios, and HML (High Minus Low) is the average return on two value portfolios minus the average return on two growth portfolios. The numbers are obtained from Kenneth R. French's website. The 4-factor model adds the Fama-French momentum factor, which is constructed from six value-weighted portfolios formed using independent sorts on size and prior returns of NYSE, AMEX, and NASDAQ stocks.[4]

As shown in Table 7, when executives from S&P 1500 firms—that are exposed to TRI plant openings—announce that they are leaving their firms, the CARs of those firms fall significantly. We present the results for all executives, CEOs, chairs of the board of directors, and non-director executives and for the three different models for computing CARs. More specifically, Panel A presents the 5-day CARs around the dates of the announced departures of executives from firms that have had at least one TRI plant opening within two miles, while Panel B presents 5-day CARs around the dates of the announced departures of executives from firms that have had no TRI plant openings within two miles. While both panels show that executive departures are associated with negative CARs, the results on the departures of executives from firms exposed to TRI plant openings (Panel A) indicate a steeper decline in CARs than firms that are not exposed to such openings (Panel B), where the differences are statistically significant (tests not shown). The comparisons in Panels C and D are similar to those in Panels A and B except that we focus on S&P 1500 firms within five miles of TRI plant openings, rather than limiting the analyses to firms within two miles. The results also

[4] The momentum factors is defined as 1/2 (Small High + Big High) - 1/2 (Small Low + Big Low), and is available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor_daily.html.

show that when executives depart from firms following TRI plant openings, CARs tend to decline significantly.

4.2. Comparison of Departing and Replacement Executives

A second implication of the view that toxic emissions spur executives to leave neighboring firms concerns the replacement executives. If pollution is making firms less appealing places to work, then these firms will find it difficult to attract replacement executives with comparable qualifications, at comparable compensation rates. To evaluate this prediction, we compare the professional experiences and earnings of the departing executives and their replacements. We do this at the individual level, where we examine the average traits of departing and replacement executives at S&P 1500 firms exposed to TRI plan openings. In particular, for all executives who leave S&P 1500 firms that are exposed to TRI plan openings, we compute three measures of their executive experience (1) the total number of years that the person has been an executive in the current or in previous companies (*Years Executive*), (2) whether the person was a chairperson of board of directors (*Ever Chair of the Board*), (3) whether the person was a CEO *(Ever CEO).* We do the same for replacement hires, i.e., executives hired by these same S&P 1500 firms. For compensation, we also compute three measures for both departing and replacement executives: (1) *Total current compensation (Salary + Bonus)* equals total current compensation from salary and bonus (excluding any exit/separation payments), (2) *Shares compensation* equals the value of an executive's compensation in the form of shares, and (3) *All other compensation* equals the value of other forms of executive compensation (where we again exclude exit/separation payments).

In Table 8, we provide simple comparison tests of the qualifications and earnings of executives who leave a firm with those who replace them. We examine four samples of S&P 1500 firms: Firms that have had at least one TRI plant opening within (1) two miles during the last year, (2) five miles within the last year, (3) two miles within the last two years, and (4) five miles within the last two years. The four panels of Table 8 correspond to each of these samples. We further restrict the sample of these S&P 1500 firms to those where at least one executive left the firm. The table gives the averages of the leaving and replacement executives along with t-tests of the significance of the differences.

Across all sub-samples, we find that departing executives have greater professional experience and were paid much more than their replacements. Specifically, compared to departing executives, the replacement hires have less executive experience, less experience as a chairperson, less experience as a CEO, and lower compensation. For example, Panel A compares departing and replacement executives in the S&P 1500 firms after a TRI plant opens within two miles. The replacements, on average, have 1.1 years of experience as executives, which is 3.6 years shorter than the executives who leave. On average, the replacements are 5.8% less likely to have experience as a chairperson and 3.1% less likely to have experience as a CEO. The replacement hires are paid less than their predecessors by almost $620,000.

4.3.Comparison of Pollutant Density between New Areas and Old Areas

Finally, the view that pollution triggers executive migration provides predictions about where those departing executives go. If executives leave S&P 1500 firms because of pollution, then we should observe these executives moving to firms in less polluted areas. To assess whether this holds, we first identify the location of the executive's new firm through BoardEx and ExecuComp. We then compute the pollutant levels in the first year after the executive moves to the new firm using EPA monitor data. Specifically, for each pollutant, we compute the pollutant's level at the executive's "old firm" and its level at the new firm, where monitor nearest to the firm measures the pollutant level.

As shown in Table 9, executives that leave S&P 1500 firms after a TRI plant opens nearby tend to move to firms in less polluted parts of the country. The change is statistically significant for seven out of the ten pollutants. These results hold both when examining S&P 1500 firms with at least one TRI plant opening within two miles and when examining firms with TRI plant openings within five miles. These results are consistent with the view that an exogenous increase in local air pollution induces a significant proportion of executives to leave their jobs. [5]

5. Conclusion

In this paper, we examined the impact of toxic emissions on the migration of corporate executives from neighboring firms. We merge data on TRI plant openings—plants that emit toxic air pollutants—with information on the career paths of executives at all S&P 1500 firms. We then ask: When one firm starts emitting toxic pollutants, does this induce the migration of corporate executives from neighboring firms and are such migrations associated with a drop in the CARs of those firms?

We find that (1) the opening of toxic emitting plants increases the rate at which executives leave geographically close firms, especially executives with more general human capital skills; (2) stock returns fall when executives announce their departures following the opening of toxic-emitting plants; (3) replacement executives have less experience and lower earnings than departing executives; and (4) migrating executives take new jobs in areas with less air pollution. The results are consistent with the view that TRI plant openings increase toxic emissions and induce corporate executives at neighboring firms to leave with adverse consequences on these corporations. These analyses suggest that an additional, costly externality of air pollution is the migration of executives in particular—and highly skilled employees more generally—from geographically close firms. Data permitting, future research may study the impact of pollution on a wider assortment of employees and incorporate these migration externalities into cost-benefit evaluations of environmental policies.

[5] We do not claim that the impact of pollution on executive migration is the only possible explanation of the results reported in Tables 7-9. We simply note that the evidence is consistent with the view that toxic emissions induce executives to leave firms and this has predictable implications on firm performance, the comparative professional experiences of the replacement executives, and the location of the new jobs of "treated" executives.

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Figure 1: Locations that Had Toxic Release Inventory (TRI) Plants Between 1996 and 2014

Notes: This figure maps the location of the 58,094 TRI plants that operated between 1996 and 2014. Each dot represents a TRI plant location.

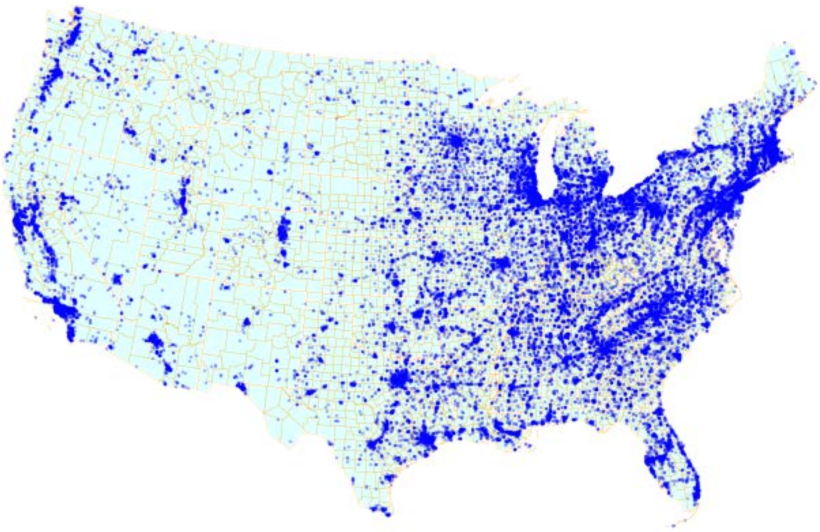

Table 1 Sample Construction and Variable Definition

This table (1) describes the construction of the three samples (Monitor-Plant-Year Sample, Firm-Year Sample, and Person-Year Sample) and (2) provides variable definitions of the dependent, independent, and control variables.

Sample Construction

Firm-Year Sample	Each row is an S&P 1500 firm's observation in a year. Data are constructed from EPA, BoardEx and Compustat.
Monitor-Plant-Year Sample	For each functioning monitor in a year, we match the TRI plant location with it and construct monitor-plant pairs. Each row is a pollutant's density (in nanograms/m^3) in a monitor-plant pair in a year. A dummy shows whether the plant is operating or not within 10 miles of the monitor in a given year. Data are from EPA.
Person-Year Sample	Each row is an executive's observation in an S&P 1500 company in a year. Data are constructed from EPA, BoardEx and Compustat.

Dependent Variables

1-factor (3-factor, 4-factor) CAR (-2， +2)	5-day CAR during the window (-2, +2), where day 0 is the date that an executive announces her leaving. We define abnormal returns by using the difference between actual and projected returns, where we estimate projected returns as follows: (1) based on 1-factor (3-factor, 4-factor) stock abnormal return model, regress the S&P 1500 firm's daily return on the returns on the CRSP value-weighted market portfolio over the 200-day period from the 210th trading day through the 11th trading day before the announcement date and collect the estimated coefficients and (2) use the estimated coefficients to compute the projected returns during the 5-day event window (-2, +2). Data are from CRSP.
All Other Compensation	The value of executive compensation that is not included in Total Current Compensation (Salary + Bonus) and Share Compensation. In thousand USD. Obtained from BoardEx and ExecuComp.
Dummy (Leave the Company in One Year)	In the person-year level data, for each executive that was in the S&P 1500 company in year *y-1*, the dummy equals one if she was in the company in year *y+1*, and equals zero if she was not in the company in year *y+1*. Constructed from BoardEx and ExecuComp.
Dummy (Leave the Company in Two Years)	In the person-year level data, for each executive that was in the S&P 1500 company in year *y-1*, the dummy equals one if she was in the company in year *y+2*, and equals zero if she was not in the company in year *y+2*. Constructed from BoardEx and ExecuComp.
Percentage of Executives Who Left the Companies in One Year	In the firm-year level data, for each S&P 1500 firm, first construct the list of all executives from BoardEx in year *y-1* (say *n* executives in total), and the list of all executives in year *y+1*; then construct the list of executives who were in the company in year *y-1* but not in year *y+1* (say there are *m* executives who have left the company); then the percentage of executives who left the company is defined as *m/n*. Constructed from BoardEx and ExecuComp.

Percentage of Executives Who Left the Companies in Two Years	In the firm-year level data, for each S&P 1500 firm, first construct the list of all executives from BoardEx in year *y-1* (say *n* executives in total), and the list of all executives in year *y+2*; then construct the list of executives who were in the company in year *y-1* but not in year *y+2* (say there are *m* executives who have left the company); then the percentage of executives who left the company is defined as *m/n*. Constructed from BoardEx and ExecuComp.
Ever Chair of the Board	A dummy indicating whether a person has been a Chairperson of Board in the current or previous companies. Obtained from BoardEx and ExecuComp.
Ever CEO	A dummy indicating whether a person has been a CEO in the current or previous companies. Obtained from BoardEx and ExecuComp.
Shares Compensation	The value of an executive's compensation in the form of granted shares. In thousand USD. Obtained from BoardEx and ExecuComp.
Total Current Compensation (Salary + Bonus)	The total current compensation of an executive, including salary and bonus, but excluding any exit/separation payments. In thousand USD. Obtained from BoardEx and ExecuComp.
Years Executive	The total number of years that the person has been an executive in the current or previous companies. Obtained from BoardEx and ExecuComp.

Independent Variables

# of TRI Opened Within 2 Miles	At the firm-year level, it is defined as the number of Toxic Release Inventory (TRI) plants newly opened within two miles of an S&P 1500 firm's headquarter location in a given year.
# of TRI Opened Within 5 Miles	At the firm-year level, it is defined as the number of Toxic Release Inventory (TRI) plants newly opened within five miles of an S&P 1500 firm's headquarter location in a given year.
Dummy (Plant is Operating)	In the monitor-plant-year sample, this dummy shows whether the plant is operating (=1) or not (=0) within five miles of the monitor in a given year.
Distance-Weighted # of TRI Plants Opened	At the firm-year level, it is defined as the number of Toxic Release Inventory (TRI) plants newly opened in a given year within five miles of an S&P 1500 firm's headquarter location weighted by the mile distance. For example, if in a given year, a company has a TRI opened 1.5 miles away, another opened 1.7 miles away, and another opened 3.5 miles away; then the company's Distance-Weighted # of TRI Plants Opened is 1/1.5+1/1.7+1/3.5 = 1.54.
Generalist CEO Index	General Ability Index defined in Custodio, Ferreira, and Matos (2013) winsorized at 1%. It captures the skills of the CEO that are transferrable across firms and industries, instead of firm-specific skills. The index gives close to equal weights to the past number of positions, firms, and industries and a lower weight to the past CEO and conglomerate experiences.

Control Variables

Age	Age of an executive. Obtained from BoardEx.
Cash Flow Volatility	Standard deviation of cash flows in the past five years. Obtained from Compustat. In million USD.
Leverage	Liabilities divided by total assets. Obtained from Compustat.

Operating Cash Flow / Total Assets Ratio	Operating cash flow divided by total assets. Constructed from Compustat.
Sales Growth	Obtained from Compustat.
Tenure	The number of years that an executive has served in the company. Constructed from BoardEx.
Total Assets	Obtained from Compustat. In million USD.

Table 2 Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Dependent Variables					
Firm-Year Level Data					
Percentage of Executives Who Left the Companies in One Year	17,047	11.855	14.023	0	100
Percentage of Executives Who Left the Companies in Two Years	15,953	22.653	19.174	0	100
Person-Year Level Data					
Dummy (Leave the Company in One Year)	86,282	0.127	0.333	0	1
Dummy (Leave the Company in Two Years)	73,900	0.183	0.386	0	1
Monitor-Plant-Year Level Data, Mean Density (nanograms)					
PM10 Total 0-10um STP	1,451,900	11627.1	14695.0	0	219578.9
Suspended particulate (TSP)	981,625	13393.2	26476.2	0	295225.8
Carbon monoxide	909,975	358.1	526.4	0	42192.9
Ozone	809,375	22.6	22.0	0	82.7
Lead (TSP) STP	877,400	42.4	406.4	0	16114.2
Sulfur dioxide	853,275	2204.5	3496.6	0	43938.4
Benzene	733,125	959.2	2354.0	0	80508.8
Toluene	722,725	2482.2	6865.3	0	513015.8
PM10 - LC	756,975	4526.9	10286.3	0	97200.0
Ethylbenzene	707,100	383.2	1118.2	0	83332.5
Key Independent Variables					
Firm-Year Level Data					
Distance-Weighted # of TRI Plants Opened	17,047	0.528	1.168	0	41.014
# of TRI Opened Within 2 Miles	17,047	0.147	0.503	0	10
# of TRI Opened Within 5 Miles	17,047	0.731	1.550	0	32
Person-Year Level Data					
Distance-Weighted # of TRI Plants Opened	86,282	0.502	1.078	0	41.014
# of TRI Opened Within 2 Miles	86,282	0.136	0.481	0	10
# of TRI Opened Within 5 Miles	86,282	0.705	1.500	0	32
Generalist CEO Index	12,565	-0.063	0.952	-1.504	6.519
Monitor-Plant-Year Level Data					
Dummy (Plant is Operating)	30,312,380	0.189	0.391	0	1

Table 2 Summary Statistics (Continued)

	Obs	Mean	Std. Dev.	Min	Max
Control Variables					
Firm-Year Level Data					
Total Assets	15,768	19.423	105.082	0.005	2573.126
Leverage	15,524	0.225	0.192	0	3.676
Operating Cash Flow / Total Assets Ratio	15,546	0.102	0.083	-0.844	1.551
Sales Growth	15,720	1.251	6.595	0.102	515.828
Cash Flow Volatility	14,838	2.004377	60.3	0	4680
Person-Year Level Data					
Total Assets	78,148	19.692	105.649	0.005	2415.689
Leverage	77,100	0.226	0.193	0	3.676
Operating Cash Flow / Total Assets Ratio	69,864	0.103	0.083	-0.844	1.551
Sales Growth	78,007	1.234	6.197	0.102	515.828
Cash Flow Volatility	73,593	1.669	53.5	0	4680
Tenure	83,946	4.364	3.998	0	22
Age	77,586	51.162	7.726	19	95

Table 3: TRI Plant Openings and Major Pollutants

This table reports the effect of TRI plant openings on air pollution. To measure air pollution, we use the annual density of major air pollutants recorded by EPA monitors within five miles of each TRI plant. The table reports the estimated coefficient on $Dummy(Plant\ is\ Operating)_{l,t}$, which is a dummy variable that equals zero in the years before a TRI plant opens and one afterwards. The last column of Table 3 provides information on the economic magnitudes of the estimated coefficient on *Dummy (Plant is Operating*) for each pollutant by computing the estimated change in the pollutant as a percentage of the pollutant's average across all monitors in the country. All regressions control for year fixed effects and monitor-plant fixed effects. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

Chemical Name	Dummy (Plant is Operating)		Constant	Year Dummy	Monitor-Plant Dummy	R-squared	Number of Monitor-Plant Pairs	Observations	Mean Density (Nanograms)	Additional % of Pollutant from One More TRI Plant
PM10 Total 0-10um STP	662.06***	(7.81)	Yes	Yes	Yes	0.345	58076	1,451,900	11627.050	5.69%
Suspended particulate (TSP)	407.94**	(2.52)	Yes	Yes	Yes	0.357	39265	981,625	13393.240	3.05%
Carbon monoxide	23.31***	(6.62)	Yes	Yes	Yes	0.388	36399	909,975	358.102	6.51%
Ozone	0.62***	(4.37)	Yes	Yes	Yes	0.395	32375	809,375	22.597	2.74%
Lead (TSP) STP	7.75**	(2.30)	Yes	Yes	Yes	0.131	35096	877,400	42.355	18.30%
Sulfur dioxide	99.37***	(4.02)	Yes	Yes	Yes	0.449	34131	853,275	2204.460	4.51%
Benzene	111.15***	(6.40)	Yes	Yes	Yes	0.198	29325	733,125	959.239	11.59%
Toluene	286.64***	(6.07)	Yes	Yes	Yes	0.197	28909	722,725	2482.186	11.55%
PM10 - LC	301.62***	(4.09)	Yes	Yes	Yes	0.361	30279	756,975	4526.893	6.66%
Ethylbenzene	32.97***	(4.54)	Yes	Yes	Yes	0.176	28284	707,100	383.226	8.60%

Table 4: Executives Departures and TRI Plant Openings

This table presents OLS regression results of the relation between the percentages of executives who leave their S&P 1500 firms in the one or two years following the opening of a nearby TRI plant. The dependent variables are the percentages of executives who leave their S&P 1500 firms in the indicated time period. The main independent variables include the distance-weighted number of TRI plant openings and the number of TRI plant openings within 2/5 miles of the S&P 1500 firm. All regressions control for firm characteristics, including *Total Assets, Leverage, Operating Cash Flow / Total Assets Ratio, Sales Growth*, and *Cash Flow Volatility*, as well as MSA-year, industry-year and firm fixed effects. Table 1 provides variable definitions. Standard errors are clustered at the MSA level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Percentage of Executives Who Left the Companies in One Year						Percentage of Executives Who Left the Companies in Two Years					
Distance-Weighted # of TRI Plants Opened	0.36**			0.41**			0.50***			0.37**		
	(2.34)			(2.14)			(3.08)			(2.28)		
# of TRI Opened within 2 Miles		0.72**			0.70**			1.73***			1.55***	
		(2.33)			(2.11)			(4.28)			(3.48)	
# of TRI Opened within 5 Miles			0.22**			0.28***			0.25*			0.25*
			(2.32)			(2.86)			(1.70)			(1.79)
Total Assets				Yes	Yes	Yes				Yes	Yes	Yes
Leverage				Yes	Yes	Yes				Yes	Yes	Yes
Operating Cash Flow / Total Assets Ratio				Yes	Yes	Yes				Yes	Yes	Yes
Sales Growth				Yes	Yes	Yes				Yes	Yes	Yes
Cash Flow Volatility				Yes	Yes	Yes				Yes	Yes	Yes
MSA-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster at MSA Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,047	17,047	17,047	13,487	13,487	13,487	15,953	15,953	15,953	12,519	12,519	12,519
R-squared	0.322	0.322	0.322	0.355	0.355	0.355	0.420	0.420	0.419	0.468	0.469	0.468

Table 5: Executive Departures and TRI Plant Openings: Individual-level Analyses

This table presents OLS regression results of the relation between each executive's decision to leave or remain in their S&P 1500. The dependent variable is a dummy variable that equals one for executives leaving the firm during a one (or two) year period and zero otherwise. The main independent variables include the distance-weighted number of TRI plant openings close to the S&P 1500 firms and the number of TRI plant openings within 2/5 miles of the firm. All regressions control for firm characteristics, including *Total Assets*, *Leverage*, *Operating Cash Flow / Total Assets Ratio*, *Sales Growth*, and *Cash Flow Volatility*, individual traits (*Tenure* and *Age*), as well as MSA-year, industry-year and firm fixed effects. Table 1 provides variable definitions. Standard errors are clustered at the MSA level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dummy (Leave the Company in One Year)						Dummy (Leave the Company in Two Years)					
Distance-Weighted # of TRI Plants Opened	0.0080***			0.0048			0.0076***			0.0078**		
	(3.8425)			(1.62)			(4.2107)			(2.4822)		
# of TRI Opened within 2 Miles		0.0227***			0.0117**			0.0266***			0.0260**	
		(5.2523)			(2.28)			(4.9016)			(2.2287)	
# of TRI Opened within 5 Miles			0.0083***			0.0062**			0.0077***			0.0074**
			(3.6962)			(2.4951)			(2.7222)			(2.3548)
Total Assets				Yes	Yes	Yes				Yes	Yes	Yes
Leverage				Yes	Yes	Yes				Yes	Yes	Yes
ROE				Yes	Yes	Yes				Yes	Yes	Yes
Sales Growth				Yes	Yes	Yes				Yes	Yes	Yes
Operating Cash Flow / Total Assets Ratio				Yes	Yes	Yes				Yes	Yes	Yes
Cash Flow Volatility				Yes	Yes	Yes				Yes	Yes	Yes
Tenure				Yes	Yes	Yes				Yes	Yes	Yes
Age				Yes	Yes	Yes				Yes	Yes	Yes
MSA-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster at MSA Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86,282	86,282	86,282	48,169	48,169	48,169	73,900	73,900	73,900	40,873	40,873	40,873
R-squared	0.393	0.394	0.394	0.432	0.432	0.432	0.533	0.534	0.533	0.559	0.559	0.559

Table 6: Individual Probability of Leaving and TRI Plant Openings: Interaction with Generalist CEO Index

This table presents OLS regression results of the relation between each CEO's decision to leave or remain in their S&P 1500 firm, while differentiating CEOs by the degree of general human capital. The dependent variables are dummies that equal one for the CEO leaving the company in one/two year(s) and zero otherwise. The main independent variables are (a) the distance-weighted number of TRI plant openings close to the S&P 1500 firms and the number of TRI plant openings within 2/5 miles of the firm and (b) the interaction of these TRI plant opening variables with the Generalist CEO Index. The Generalist CEO Index measures the skills of the CEO that are transferrable across firms and industries. All regressions control for firm characteristics, individual traits, and MSA-year, industry-year and firm fixed effects. Table 1 provides variable definitions. Standard errors are clustered at the MSA level. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dummy (Leave the Company in One Year)						Dummy (Leave the Company in Two Years)					
Distance-Weighted # of TRI Plants Opened	0.0075***			0.0017			0.0099***			0.0062		
	(2.93)			(0.39)			(3.00)			(1.09)		
Distance-Weighted # of TRI Plants Opened*Generalist CEO Index	0.0108***			0.0126*			0.0142***			0.0112*		
	(2.84)			(1.66)			(4.97)			(1.69)		
# of TRI Opened within 2 Miles		0.0102			-0.0006			0.0267**			0.0197	
		(1.17)			(-0.06)			(2.23)			(1.48)	
# of TRI Opened within 2 Miles*Generalist CEO Index		0.0203**			0.0287*			0.0299***			0.0360*	
		(2.30)			(1.69)			(3.00)			(1.96)	
# of TRI Opened within 5 Miles			0.0035			-0.0019			0.0060**			0.0006
			(1.23)			(-0.49)			(1.99)			(0.09)
# of TRI Opened within 5 Miles*Generalist CEO Index			0.0066***			0.0078**			0.0092***			0.0090**
			(2.62)			(2.11)			(5.16)			(2.46)
Generalist CEO Index	0.1822***	0.1857***	0.1853***	0.2228***	0.2246***	0.2247***	0.2749***	0.2806***	0.2791***	0.3276***	0.3284***	0.3290***
	(5.09)	(5.31)	(5.24)	(3.51)	(3.66)	(3.57)	(4.99)	(5.16)	(5.07)	(3.36)	(3.48)	(3.45)
Total Assets				Yes	Yes	Yes				Yes	Yes	Yes
Leverage				Yes	Yes	Yes				Yes	Yes	Yes
ROE				Yes	Yes	Yes				Yes	Yes	Yes
Sales Growth				Yes	Yes	Yes				Yes	Yes	Yes
Operating Cash Flow / Total Assets Ratio				Yes	Yes	Yes				Yes	Yes	Yes
Cash Flow Volatility				Yes	Yes	Yes				Yes	Yes	Yes
Tenure				Yes	Yes	Yes				Yes	Yes	Yes
Age				Yes	Yes	Yes				Yes	Yes	Yes
MSA-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster at MSA Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,565	12,565	12,565	8,577	8,577	8,577	11,543	11,543	11,543	7,837	7,837	7,837
R-squared	0.507	0.507	0.507	0.589	0.589	0.589	0.609	0.610	0.609	0.685	0.685	0.685

Table 7: CAR around Executives' Turnover Announcement

Panel A presents t-test results of the 5-day CARs around the announcement dates of executive departures from S&P 1500 firms in which at least one TRI plant opened within two miles. Panel B presents t-test results of the 5-day CARs around the announcement dates of executive departures from S&P 1500 firms in which no TRI plant opened within two miles. Panel C presents t-test results of the 5-day CARs around the announcement dates of executive departures from S&P 1500 firms in which at least one TRI plant opened within five miles. Panel D presents t-test results of the 5-day CARs around the announcement dates of executive departures from S&P 1500 firms in which no TRI plant opened within five miles. Each of the four sub-tables reports analyses of the departures of (1) all executives (2) executives who are not members of the board of directors, (3) CEOs, and (4) the chairs of the board of directors. Robust t-statistics are in parentheses. *, **, *** indicate significance at 1%, 5% and 10%.

Panel A: 5-day CARs around the turnover announcement dates of the executives whose firms have at least one plant opening within two miles

	Mean	t-Statistic	Observations
All			
1-factor CAR (-2，+2)	-1.53%***	(-3.257)	172
3-factor CAR (-2，+2)	-1.47%***	(-3.111)	172
4-factor CAR (-2，+2)	-1.48%***	(-3.142)	172
Non-director			
1-factor CAR (-2，+2)	-2.02%***	(-3.377)	132
3-factor CAR (-2，+2)	-1.92%***	(-3.184)	132
4-factor CAR (-2，+2)	-1.89%***	(-3.157)	132
CEO			
1-factor CAR (-2，+2)	-2.01%***	(-2.586)	61
3-factor CAR (-2，+2)	-1.77%**	(-2.286)	61
4-factor CAR (-2，+2)	-1.72%**	(-2.227)	61
Chairman			
1-factor CAR (-2，+2)	-5.79%**	(-2.030)	18
3-factor CAR (-2，+2)	-6.13%**	(-2.175)	18
4-factor CAR (-2，+2)	-5.95%**	(-2.099)	18

Panel B: 5-day CARs around the turnover announcement dates of the executives whose firms have no plant opening within two miles

	Mean	t-Statistic	Observations
All			
1-factor CAR (-5，+5)	-0.39%***	(-4.580)	1,607
3-factor CAR (-5，+5)	-0.4%***	(-4.774)	1,607
4-factor CAR (-5，+5)	-0.47%***	(-5.553)	1,607
Non-director			
1-factor CAR (-5，+5)	-0.31%***	(-3.219)	1,295
3-factor CAR (-5，+5)	-0.33%***	(-3.510)	1,295
4-factor CAR (-5，+5)	-0.42%***	(-4.394)	1,295
CEO			
1-factor CAR (-5，+5)	-0.54%***	(-4.204)	581
3-factor CAR (-5，+5)	-0.54%***	(-4.328)	581
4-factor CAR (-5，+5)	-0.64%***	(-5.050)	581
Chairman			
1-factor CAR (-5，+5)	-0.84%***	(-2.815)	202
3-factor CAR (-5，+5)	-0.86%***	(-2.946)	202
4-factor CAR (-5，+5)	-0.96%***	(-3.211)	202

Panel C: 5-day CARs around the turnover announcement dates of the executives whose firms have at least one plant opening within five miles

	Mean	t-Statistic	Observations
All			
1-factor CAR (-2， +2)	-0.66%***	(-3.953)	437
3-factor CAR (-2， +2)	-0.71%***	(-4.237)	437
4-factor CAR (-2， +2)	-0.73%***	(-4.409)	437
Non-director			
1-factor CAR (-2， +2)	-0.89%***	(-2.847)	361
3-factor CAR (-2， +2)	-0.92%***	(-2.955)	361
4-factor CAR (-2， +2)	-0.87%***	(-2.835)	361
CEO			
1-factor CAR (-2， +2)	-0.74%***	(-3.483)	166
3-factor CAR (-2， +2)	-0.72%***	(-3.394)	166
4-factor CAR (-2， +2)	-0.71%***	(-3.342)	166
Chairman			
1-factor CAR (-2， +2)	-1.27%**	(-1.950)	59
3-factor CAR (-2， +2)	-1.34%**	(-2.076)	59
4-factor CAR (-2， +2)	-1.53%**	(-2.304)	59

Panel D: 5-day CARs around the turnover announcement dates of the executives whose firms have no plant opening within five miles

	Mean	t-Statistic	Observations
All			
1-factor CAR (-5， +5)	-0.38%***	(-5.288)	1,176
3-factor CAR (-5， +5)	-0.38%***	(-5.478)	1,176
4-factor CAR (-5， +5)	-0.43%***	(-6.183)	1,176
Non-director			
1-factor CAR (-5， +5)	-0.33%***	(-3.029)	974
3-factor CAR (-5， +5)	-0.35%***	(-3.309)	974
4-factor CAR (-5， +5)	-0.43%***	(-4.399)	974
CEO			
1-factor CAR (-5， +5)	-0.63%***	(-5.347)	433
3-factor CAR (-5， +5)	-0.62%***	(-4.897)	433
4-factor CAR (-5， +5)	-0.75%***	(-5.764)	433
Chairman			
1-factor CAR (-5， +5)	-0.93%***	(-4.421)	154
3-factor CAR (-5， +5)	-1.01%***	(-4.372)	154
4-factor CAR (-5， +5)	-1.02%***	(-4.592)	154

Table 8: Comparisons of Departing and Replacement Executives

This table compares the experiences and compensation of departing and replacement executives. We examine four samples of S&P 1500 firms: Firms that have had at least one TRI plant opening within (1) two miles during the last year (Panel A), (b) five miles within the last year (Panel B), (c) two miles within the last two years (Panel C), and (d) five miles within the last two years (Panel D). The sample includes S&P 1500 firms in which at least one executive left the firm. We examine five characteristics of each executive: (1) number of years as an executive, (2) a dummy indicating whether the executive was ever a chair of a board of directors, (3) a dummy indicating whether the executive was ever a CEO, (4) total current compensation in the last year(salary plus bonus), (5) the value of shares received as compensation during the last year, and (5) other forms of compensation in the last year. The table gives the averages of the departing and replacement executives along with t-tests of the differences.

Panel A: TRI plant opened within two miles in the past one year

	Average for Executives who Left the Companies in Firms that Have At Least One TRI Plant Open within 2 Miles in the Last Year	Average for Replacement Hires in Firms that Have At Least One TRI Plant Open within 2 Miles in the Last Year	Diff	t-Statistic
Years Executive	4.737	1.127	3.609***	(30.44)
Ever Chair of Board	0.107	0.0486	0.0587***	(5.941)
Ever CEO	0.101	0.0705	0.0306***	(2.948)
Total Current Compensation (Salary + Bonus)	720.7	546.1	174.6***	(4.159)
Shares Compensation	260.9	109.4	151.5***	(3.079)
All Other Compensation	422.6	121.9	300.6***	(6.563)
Observations	1,454	1,460		

Panel B: TRI plant opened within five miles in the past one year

	Average for Executives who Left the Companies in Firms that Have At Least One TRI Plant Open within 5 Miles in the Last Year	Average for Replacement Hires in Firms that Have At Least One TRI Plant Open within 5 Miles in the Last Year	Diff	t-Statistic
Years Executive	4.883	1.182	3.701***	(46.95)
Ever Chair of Board	0.104	0.0467	0.0578***	(11.76)
Ever CEO	0.0995	0.0679	0.0316***	(6.913)
Total Current Compensation (Salary + Bonus)	738.3	606.5	131.8***	(2.097)
Shares Compensation	328.1	91.86	236.3***	(4.733)
All Other Compensation	394.4	116.3	278.1***	(10.09)
Observations	4,182	4,215		

Panel C: TRI plant opened within two miles in the past two years

	Average for Directors and Executives who Left the Companies in Firms that Have At Least One TRI Plant Open within 2 Miles in the Past Two Years	Average for Replacement Hires in Firms that Have At Least One TRI Plant Open within 2 Miles in the Past Two Years	Diff	t-Statistic
Years Executive	5.098	1.138	3.960***	(25.84)
Ever Chair of Board	0.0879	0.0397	0.0482***	(5.083)
Ever CEO	0.0938	0.0689	0.0250**	(2.773)
Total Current Compensation (Salary + Bonus)	625.9	515	110.9***	(3.524)
Shares Compensation	413.2	306.1	107.1	(0.647)
All Other Compensation	318	131.3	186.7***	(4.679)
Observations	1,535	1,612		

Panel D: TRI plant opened within five miles in the past two years

	Average for Directors and Executives who Left the Companies in Firms that Have At Least One TRI Plant Open within 5 Miles in the Past Two Years	Average for Replacement Hires in Firms that Have At Least One TRI Plant Open within 5 Miles in the Past Two Years	Diff	t-Statistic
Years Executive	5.051	1.27	3.781***	(47.05)
Ever Chair of Board	0.0947	0.0415	0.0532***	(11.06)
Ever CEO	0.0966	0.063	0.0336***	(6.833)
Total Current Compensation (Salary + Bonus)	699.1	585.2	113.9***	(4.576)
Shares Compensation	363.6	190.4	173.3**	(2.495)
All Other Compensation	381.7	126.9	254.8***	(11.19)
Observations	4,563	4,553		

Table 9: Comparison of Pollution Levels of the Location of Departing Executives

This table compares the pollution levels at the locations of the departing executive's original and new firms. The sample includes executives who left S&P 1500 firms following a TRI plant opening nearby and moved to become an executive at another firm. Panel A considers executives who left an S&P 1500 firm with at least one TRI plant opening within two miles of the firm in the last year. Panel B considers executives who left an S&P 1500 firm with at least one TRI plant opening within two miles of the firm in the last two years. Panel C considers executives who left an S&P 1500 firm with at least one TRI plant opening within five miles of the firm in the last year. Panel D considers executives who left an S&P 1500 firm with at least one TRI plant opening within five miles of the firm in the last two years.

Panel A: Executives leaving S&P 1500 firms with at least one plant opening within two miles in the past year.

	Sample: Executives who Left the S&P 1500 Firms with at Least One Plant Opening within 2 Miles in the Past One Year				
Pollutant	New Area	Original Area	Diff	t-Statistic	Observations
PM10 Total 0-10um STP	22.82	23.94	-1.128**	-2.071	232
Suspended particulate (TSP)	54.43	59.33	-4.891	-1.007	32
Carbon monoxide	0.564	0.62	-0.0564***	-2.783	240
Ozone	0.0411	0.0405	0.000537	0.994	291
Lead (TSP) STP	0.0158	0.0248	-0.00907	-1.039	89
Sulfur dioxide	3.07	4.006	-0.936***	-3.695	180
Benzene	2.164	2.391	-0.227**	-2.313	171
Toluene	6.041	7.31	-1.269***	-4.433	166
PM10 - LC	21.46	22.93	-1.471**	-2.298	109
Ethylbenzene	1.045	1.281	-0.236***	-4.295	165

Panel B: Executives who left S&P 1500 firms with at least one plant opening within two miles in the past two years.

	Sample: Executives who Left the S&P 1500 Firms with at Least One Plant Opening within 2 Miles in the Past Two Years				
Pollutant	New Area	Original Area	Diff	t-Statistic	Observations
PM10 Total 0-10um STP	22.7	23.69	-0.990***	-2.447	392
Suspended particulate (TSP)	53.2	56.28	-3.082	-0.96	51
Carbon monoxide	0.552	0.595	-0.0428***	-3.003	402
Ozone	0.0409	0.0404	0.000535	1.338	501
Lead (TSP) STP	0.0184	0.0215	-0.00311	-0.494	130
Sulfur dioxide	3.163	4.152	-0.990***	-4.764	292
Benzene	2.121	2.437	-0.316***	-3.351	289
Toluene	6.038	7.098	-1.060***	-3.324	277
PM10 - LC	21.56	22.76	-1.201***	-2.371	179
Ethylbenzene	1.044	1.191	-0.146***	-2.635	274

Panel C: Executives who left S&P 1500 firms with at least one plant opening within five miles in the past year.

	Sample: Executives who Left the S&P 1500 Firms with at Least One Plant Opening within 5 Miles in the Past One Year				
Pollutant	New Area	Original Area	Diff	t-Statistic	Observations
PM10 Total 0-10um STP	22.83	23.57	-0.733***	-2.36	707
Suspended particulate (TSP)	55.04	57.21	-2.161	-0.681	105
Carbon monoxide	0.547	0.594	-0.0471***	-4.31	720
Ozone	0.041	0.0405	0.000545	1.893	887
Lead (TSP) STP	0.0195	0.0307	-0.0112**	-1.702	236
Sulfur dioxide	2.844	3.482	-0.638***	-4.871	550
Benzene	2.087	2.292	-0.204***	-2.819	524
Toluene	5.764	6.733	-0.968***	-3.939	514
PM10 - LC	21.75	22.62	-0.872**	-2.112	293
Ethylbenzene	0.994	1.081	-0.0873**	-2.166	504

Panel D: Executives who left S&P 1500 firms with at least one plant opening within five miles in the past two years.

	Sample: Executives who Left the S&P 1500 Firms with at Least One Plant Opening within 5 Miles in the Past Two Years				
Pollutant	New Area	Original Area	Diff	t-Statistic	Observations
PM10 Total 0-10um STP	22.73	23.16	-0.434**	-1.688	984
Suspended particulate (TSP)	52.63	54.47	-1.839	-0.68	145
Carbon monoxide	0.534	0.576	-0.0420***	-4.754	995
Ozone	0.0409	0.0406	0.000319	1.321	1,251
Lead (TSP) STP	0.0202	0.0294	-0.00923**	-1.749	298
Sulfur dioxide	2.979	3.518	-0.539***	-4.598	761
Benzene	2.057	2.237	-0.179***	-3.131	731
Toluene	5.73	6.404	-0.675***	-3.317	717
PM10 - LC	21.8	22.41	-0.611**	-1.901	414
Ethylbenzene	0.986	1.022	-0.0353	-0.848	702