Forming Coalitions for Cleaner Air?

by

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During the 1990s, most California cities have experienced a sharp decrease in particulate-matter air pollution. The magnitude of the improvement in this amenity differs across cities. In ongoing work, Ê *we show empirical evidence that more ethnically homogeneous cities have experienced larger drops in ambient* Ê *concentrations. We argue that this is consistent with a model of coalition formation.* Ê

An extensive literature in sociology and political science addresses a concept known as environmental justice. The hypothesized phenomenon at the center of this debate is the argument that low-income households and minorities are exposed to larger levels of pollution relative to better off or majority households. Two arguments have been brought forth to explain the empirical finding of this effect. The first relates to a sorting effect, whereby poorer households and minorities sort into communities with lower levels of amenities to take advantage of lower-cost housing. The second, which is more contested, argues that polluting facilities intentionally locate in cities which are inhabited by poorer households and minorities.

While this argument may hold with respect to location of facilities within cities, there are a few concerns that have been raised in relation to studies looking at variation in pollution exposure across cities. First, there is no obvious economic motivation for why firms should locate in cities with larger minority populations, while controlling for other characteristics of the resident population such as experience, education and age. Further, it is not quite clear in the urban context, what constitutes a minority population. In the literature, minorities are often defined as the share of "non-white" population. Looking across California cities, this measure does not capture the correct definition of a "voting minority" for 21 percent of the 1,023 cities we consider, which make up 89 percent of California's total population.

In this ongoing work, we are rephrasing the question asked and argue that the ability by populations to form coalitions to successfully lobby authorities, or to elect representatives to decision-making administrative bodies, may provide a better explanation for observed trends in air pollution exposure.

The Clean Air Act Amendments (CAAAs) of 1990 required the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQs) for pollutants considered harmful to public health and the environment, including particles of 10mm in diameter or less (PM_{10}). Specifically, the CAAAs clarify how areas are designated as being "in attainment." The CAAAs also allow the EPA to define the boundaries of "nonattainment" areas: geographical areas whose air quality does not meet the NAAQs which are designed to protect public health.

The California Air Resources Board (CARB) has divided the state of California into 15 air basins, which were then subdivided into various Air Quality Management Districts (AQMDs) or Air Pollution Control Districts (Figure 1). These management districts were chosen based on their meteorological and geographic conditions, in addition to the local political boundaries. The inclusion of political boundaries into the regional management of the AQMDs, and the appointment of elected officials onto the AQMDs' governing boards is the driving force behind this research: if the elected officials are representing the preferences of their constituents, then it is likely that political variables will enter the decisions that the AQMDs make. In this case, it is possible that one could predict the degree of non- or overcompliance with the NAAQs based on the preferences of the constituents.

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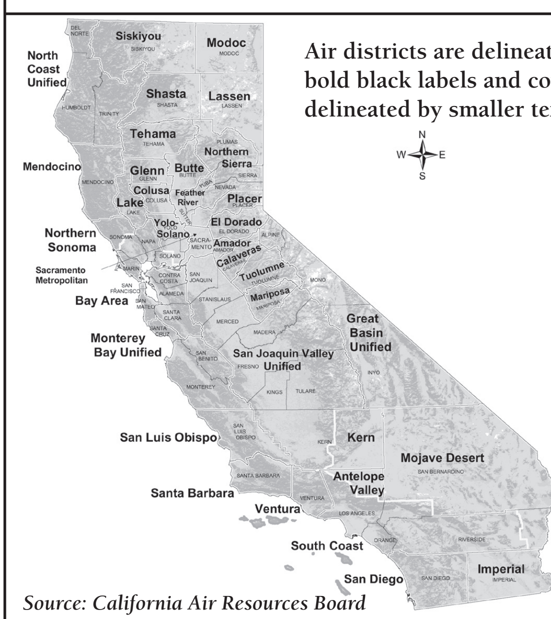
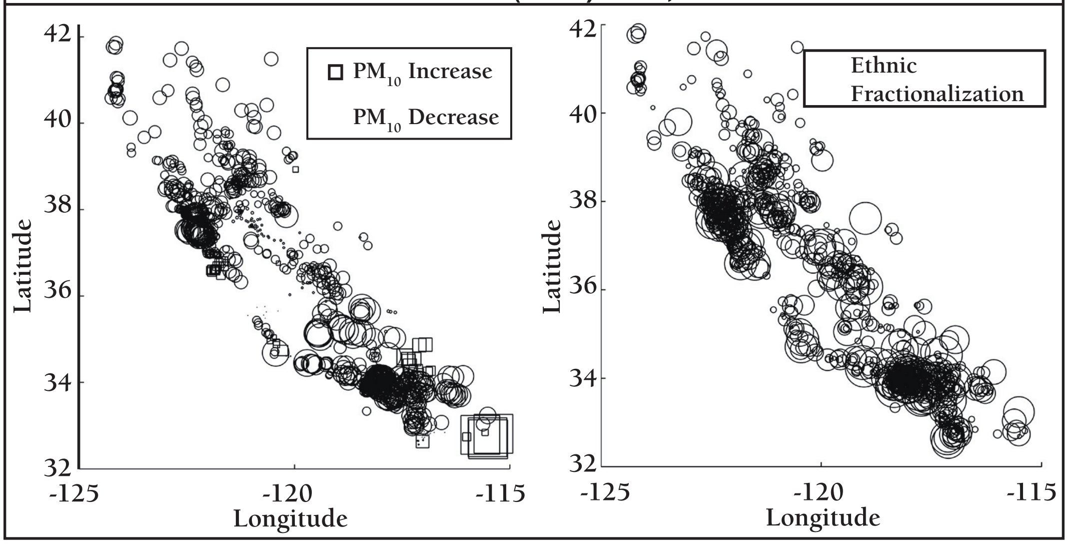


Air districts are delineated by bold black labels and counties are delineated by smaller text labels.

Source: California Air Resources Board

Figure 2: Change in PM_{10} Concentration (1990 to 2000) and Ethnic Fractionalization (1990) for 1,023 California Cities



Description of the Model and Data

As a basis for our empirical model, we propose a theoretical framework which shows how members of a community with preferences for a variety of public goods vote for a candidate to represent them on a body deciding on the allocation of the public good in question (in our case lack of air pollution). They chose the candidate who most closely matches their preferences. An election process evolves under which officials are lobbied by industry, while at the same time having to garner enough support from individuals with preferences for clean air. A lack of coalition formation or uniformity of the electorate results in the elected official's stronger preference for concerns raised by industry. Previous analyses of government expenditures in racially fragmented communities have shown that spending on public goods such as parks and trash pickup in U.S. cities is inversely related to the cities' ethnic fragmentation, even after controlling for socioeconomic and demographic variables. We argue that more ethnically fragmented cities have higher transaction costs of coalition formation and therefore experience "worse" outcomes.

We extend this literature by considering how changes in particulate-matter pollution from 1990 to 2000 vary across California cities and what factors drive these observed differences. The variable we are attempting to explain is the observed change in particles of 10mm in diameter or less (PM_{10}) relative to the national standard of 50 μg/m3, which is the annual average concentration. These ambient concentrations have been monitored through an extensive network operated by California state agencies since the mid 1980s. Consistent with our model and the literature, we use a set of variables characterizing preferences of voters to explain variation in the observed concentration changes. We control for the share of seniors, children below the age of nine, mean household in-come, income distribution and education. These variables are thought to reflect constituents' preferences for local public goods and therefore govern voting behavior. To construct our measure of fragmentization, we use data on the share of the five ethnic groups collected by the U.S. Census. This is different from considering the share of the non-white population, since a mostly Hispanic city (e.g., East Los Angeles) will show up as a homogeneous town the same way a mostly white city (e.g., Newport Beach) will. The focus therefore shifts from a minority story to a coalition story. Figure 2 above demonstrates the heterogeneity of the change in PM_{10} concentrations and the difference in ethnic fractionalization across California cities.

In the left panel, circles indicate decreases in PM_{10} concentrations for a given California city, while squares indicate an increase in concentration. The larger the circle/square, the larger the experienced de/increase. It is noteworthy that most of the cities which experienced increased PM_{10} concentrations are located in Southern California. Ethnic fractionalization is measured using an index, which ranges from 0 to 0.8, with 0.8 indicating the largest degree of fractionalization and 0 indicating a homogeneous city. The right panel shows the large variation in ethnic heterogeneity across California's cities. Orange County, for example, is fairly homogeneous while Riverside is very heterogeneous.

Results and Discussion

We considered a large variety of specifications and found a robust negative relationship between the degree of fractionalization and the experienced drop in emissions for California's cities—in other words, cities with more ethnic fragmentation experienced less improvement in emissions. This finding is robust if we consider all cities, cities above 5,000 inhabitants, or cities with populations larger than 25,000. Our estimates indicate that cities with a larger share of seniors and small children, wealthier households and a more equal income distribution experienced a larger decrease in emissions, holding all else constant. We also show evidence that larger cities and cities with a larger share of college graduates experienced smaller decreases in emissions. These findings are robust whether we include the few cities which actually experienced increased emissions.

Table 1 shows the list of the five most and least fragmented cities along the ethnic dimension in California. To get a feeling for the impact of ethnic fractionalization, we have calculated a few counterfactual experiments for the most and least fragmented cities with populations of more than 50,000. The counterfactual for the least fragmented cities is to assume that they started in 1990 with the degree of fractionalization of Carson, CA, a city with a highly fragmented population. The counterfactual column indicates the hypothesized level of year 2000 PM_{10} concentrations using the fragmented (Carson) electorate. The counterfactual shows much higher particulate concentrates than what occurred in reality for the least fragmented cities. We perform the same experiment for the most fragmented cities by showing the predicted year 2000 PM_{10} concentrates, for the counterfactual scenario of an almost perfectly homogeneous society, using the East Los Angeles value of 0.11. Here, we see the scope of environmental improvement that might have been obtained through the coalitional capabilities of a homogeneous population.

Using econometric techniques designed for model selection, we split the sample into cities which, by the NAAQs definition, were in compliance and cities which were not in compliance. We further controlled for the potential existence of unobservable characteristics of AQMDs, which may taint our results. Using this approach, an interesting pattern emerges. The coalition formation effect is significantly larger for cities which were not in compliance with the 1990 amendments. Further, we show that the effect is stronger for smaller cities, which is consistent with the argument that coalitions form more easily in smaller communities. The results are robust to controlling for unobservable effects across AQMDs, which indicates that city-specific characteristics of the population and ethnic makeup have a significant impact on observed improvements in air quality.

Table 1. California's Most and Least Fragmented Cities, 1990

Least Fragmented	Ethnic Index	PM 1990	PM 2000	Counter-factual
East Los Angeles	0.11	52.94	39.98	52.34
Newport Beach	0.14	41.22	27.78	39.49
Redding	0.19	29.70	18.86	29.57
Walnut Creek	0.22	26.36	18.09	28.25
Most Fragmented				
Stockton	0.69	51.36	33.67	22.45
Oakland	0.69	33.62	24.63	13.37
Union City	0.71	32.12	21.72	10.12
Carson	0.75	41.22	39.98	27.62

From a policy perspective, this is encouraging. The California Health and Safety Code specifies that the governing boards of the AQMD consist of city mayors and county officials and further that "the governing board shall reflect [...] the variation of population between the cities in the district." The observed reductions in ambient concentrations are consistent with predictions from our model, which is based on this structure.

Conclusions

Understanding what drives the spatial heterogeneity in the level of amenities across California's cities is of great importance for the design of efficient policies. In the case of particulate air pollution, we show that the ability of communities to form coalitions has a statistically significant and reasonably small-sized impact on the experienced drops in ambient concentrations. This is encouraging from a community perspective since, in the case of particulates, working together is likely to result in a better outcome for the community.

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