Race, Class, and the Production of and Exposure to Vehicular Pollution in Los Angeles

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Project Objective

Vehicular air pollution has created an ongoing public health crisis. Through a Los Angeles case study, we examine how different communities' driving volume and exposure to vehicular air pollution relate to race/ethnicity and socioeconomic status, and how this relationship varies across the region.

Problem Statement

Exposure to air pollution from cars, including particulate matter of 2.5 microns or smaller ($PM_{2.5}$), poses a significant risk to human health. In US cities, individuals' exposure is largely determined by residential locations, climate and terrain conditions, travel behavior, and racially-motivated planning decisions. Historical planning decisions manifest themselves today in disparate transportation infrastructure usage and driving behavior that concentrate hazardous vehicular pollution in minority communities. This study asks: how much vehicular pollution are different communities exposed to in relation to how much—and where—their residents drive?

Research Methodology

We answer this question in the context of race, class, and driving in Los Angeles County with a twofold analytical approach. First, we use ordinary least squares (OLS) and geographically weighted regression (GWR) regression analyses to measure the relationship between driving and emissions exposure. This models census tract-level $PM_{2.5}$ concentrations attributable to on-road sources as a function of vehicle kilometers traveled (VKT) by tract residents, controlling for local demographics, socioeconomic status, and street network characteristics. It uses tract-level VKT production data from the Local Area Transportation Characteristics for Households (LATCH) and vehicular $PM_{2.5}$ emissions data from the Union of Concerned Scientists. Second, we simulate commutes to identify who generates the excess driving through areas that rank lower in terms of VKT production. This evaluates the routes chosen respectively by white and by non-white commuters within Los Angeles County to understand how the demographics of commuters traversing a tract resemble the tract's residents and to identify where they most differ. Using census block-level home and work locations, we simulate commute routes and compare the share of all commuter kilometers driven through a tract by non-Hispanic white commuters to the share of the tract's population that is non-Hispanic white.

Results

We find a negative association between VKT and exposure to vehicular $PM_{2.5}$. That is, all else equal, residents of communities that drive more tend to be less exposed to vehicular pollution themselves. A 1% increase in local VKT production is associated with a 0.62% decrease in local $PM_{2.5}$ exposure. Allowing for heterogeneity in this statistical relationship by using GWR instead of OLS, we find substantial variation across the county, but the association between VKT and $PM_{2.5}$ exposure is negative in far more tracts than it is positive.

While commutes originating in majority-white tracts often traverse great distances through majority non-white parts of the county, the reverse is far less common: Los Angeles County is only 26% non-Hispanic white but, along major regional freeways, we observe discrepancies of up to 13 percentage points between the shares of traversing commuters and of the local population that are white. By utilizing freeways, White commuters traverse tracts that are far more non-White than the tracts where most of them live, on average. They disproportionately receive the benefits of driving on a highway, but because those highways are predominantly in non-White neighborhoods, other racial groups bear many of the external costs of that driving.

Overall, different communities are not exposed to vehicular pollution at a level proportional to how much they drive, and past infrastructure planning and housing policy play a central role in explaining these disparities. All else equal, tracts whose residents drive less experience more vehicular air pollution. Furthermore, tracts with a larger non-White population share—whether high income or low income—experience more air pollution than do Whiter but otherwise similar tracts. On average, White commuters traverse tracts that are far more non-White than the tracts where they live, but non-White commuters do not travel through tracts that are substantially Whiter than their own. This reveals an injustice in pollution burden with a distinct racial dimension, as the burden of pollution exposure falls disproportionately on communities that drive less and that are on average less white. This is largely driven by past planning and policy, and it is up to current planners and policymakers to attenuate this injustice—but there is no silver bullet. However, vehicle electrification, congestion tolls, improved public transit options, and better housing policy can help mitigate these harms.

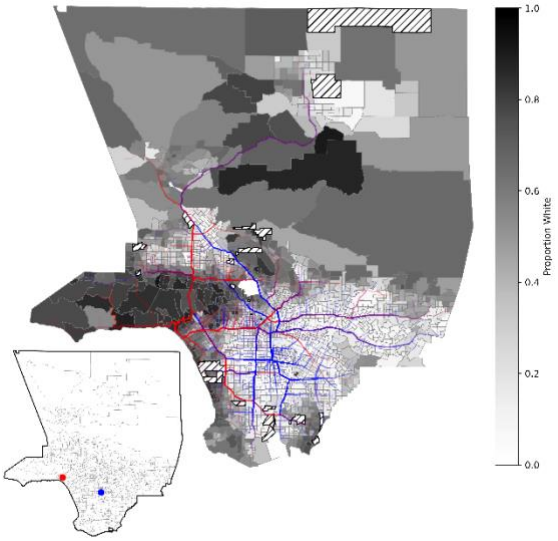

Figure 2. Commute routes for a typical high-income White tract and low-income minority tract: red represents routes from a majority White tract, blue represents routes from a majority non-White tract, and grey represents the proportion White in the tract. The inset shows the location of the two case study tracts.

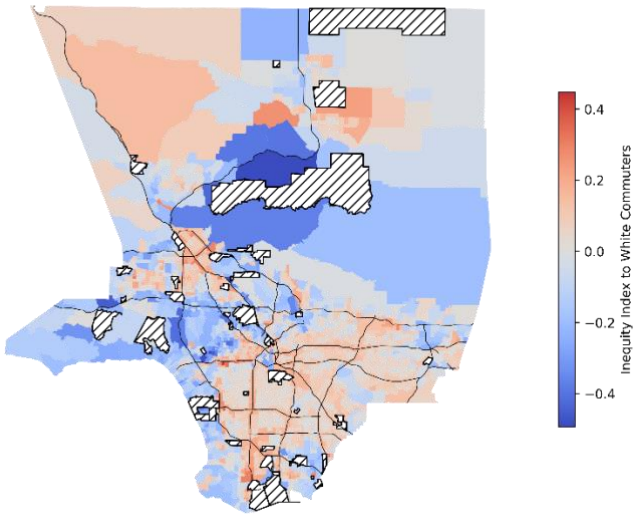

Figure 1. Distribution of local inequity index relative to White commuters and its proximity to highways.