LSE Spatial Economics Research Centre

East Side Story: Historical Pollution and Neighbourhood Sorting

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> "In Manchester [...] prevailing and strongest winds [blow] from the South West. This meant that when the dense sulphurous smoke left Manchester's t
> chimneys it usually moved North East, and this was to have a marked effect on the shaping of the city."

> Stephen Mosley, 2013, The Chimney of the Wor

The East Sides of cities such as London, Vancouver, New York and Paris have historically been the poorest. Some, but not all, have gentrified more recently, and this gentrification has been at the centre of media attention. These observations uncover two questions. Why were these neighbourhoods poor to begin with, and why did some gentrify while others did not? Our answer to this question has been recently discussed in a Guardian article titled "Blowing in the wind: why do so many cities have poor east ends?"

Pollution and sorting
The explanation lies in the air pollution emitted by the coal-burning factories of the industrial era. During the Industrial Revolution, many areas of Manchester, for example, were covered with layers of soot. Black stains on the pavements and buildings of areas such as Victoria Station or Ancoats i North-East Manchester remained until very recently. With the wrong weather, some areas could be submerged under dark, thick smog. This environmental disamenity made them unpleasant places to live and, in response, those who could afford moved to the neighbourhoods spared by the pollution. This sorting resulted in an unequal distribution of social classes across the city. Since the prevailing winds (The Westerlies) in the northern hemisphere blow from the West to the East, the most visible component of such process ended up being the observed West-East differential in neighbourhood composition.

In Heblich, Trew and Zylberberg (2016), we document this process focusing on the industrial cities of Victorian England. We reconstruct atmospheric pollution and neighbourhood composition at a precise geographic level across English cities using a combination of historic Ordinance Survey maps an individual census records around the year 1881. To locate the main pollution sources, we identify the location of around 5,000 industrial chimneys on these maps and reconstruct the average annual atmospheric pollution within cities using recent atmospheric dispersion models. The chimneys of Victorian England were not very tall compared to modern standards and the coal was burned at a lower temperature. As a result, the distribution of pollution was markedly influenced by topography and wind conditions. It was also more severe -- in cities like Manchester, neighbourhoods such as Ancoats were far more polluted than contemporary Beijing while some others (e.g., Davyhulme) were below the current pollution alert levels. We find t these pollution disparities are reflected in neighbourhood composition. There is a strong connection between the presence of air pollution and the shar of low-skilled workers at the end of the nineteenth century. Figure 1 shows that such a correlation was absent before coal became the major energy source at the beginning of the century. The observed effect is substantial: the difference between being in the 10% and 90% most polluted neighbourhoods of Manchester was a difference of about 20 percentage points in the share of low-skilled workers. Most interestingly, the relationship between the presence of historic pollution and the share of low skilled workers in 2011 turns out to be quantitatively comparable to the one observed a the end of the nineteenth century.

Smoke abatement and the persistence of segregation
The previous result leaves one question unanswered. How could sorting caused by 1880 pollution be visible nowadays almost 100 years after the 192 Smoke Abatement Act and 50 years after the Clean Air Acts (which quickly and considerably reduced the extent of coal-based pollution within cities)? While the average correlation between (past) air pollution and the share of low-skilled workers is almost as large as before in 2011, this observation masks important differences. In neighbourhoods where past pollution levels were close to the city average (either slightly lower or higher), social segregation disappeared between the Clean Air Acts and today. For instance, cities with low overall levels of pollution, where all neighbourhoods were close to the city average, do not display any West-East differences in outcomes today. By contrast, neighbourhoods where past pollution was well abo or well below the city average (mostly present in cities with high average pollution) are locked in their historical equilibrium. These non-linearities in the persistence of neighbourhood composition are shown in Figure 1. This illustrates the existence of 'tipping dynamics': past a certain threshold, a poor neighbourhood repels richer residents even when the original disamenity has long waned. While it is beyond the scope of our project to identify the ma channels at play, we present indicative evidence that this might be related to (the lack of) work opportunities, school composition (Free-Meal pupils), crime incidence or the quality of the housing stock.

Figure 1: Share of low-skilled workers and pollution (1817, 1881, 1971-2011).
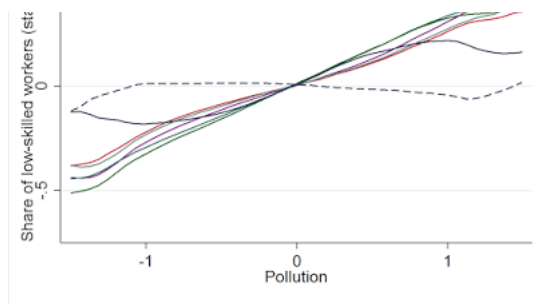
So what? Let us go back to the original question. Why are the East Sides of post-industrial cities so poor? Our findings suggest that they are poor because of the high levels of pollution during the industrial golden age, the tendency for the smoke to drift toward the East, the associated neighbourhood sorting and the persistence of segregation in very poor districts.

Could these findings inform policies today? First, there are large environmental disamenities in cities of developed economies, and even more pressing challenges in the cities of developing economies. In both cases, disamenities may be unequally spread within cities. The East Side Story shows that any such spatial inequality may anchor neighbourhoods in a persistent equilibrium, and there may be large costs associated with long-term spatial inequalities. Second, many developed economies employ costly urban policies to revive deprived areas, triggering new housing opportunities and business investment. Our findings indicate the importance of a sizable push to bring a neighbourhood past a certain threshold.

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