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The Costs and Benefits of Fixing Downtown Freeways

Urban freeways spurred our suburban boom. Can burying them do the same for the urban core?

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Freeways are conspicuous features of urban landscapes.[1] Highway construction represented a massive infrastructure investment in the 20th century, and it improved access, commuting, and trade. Nonetheless, it has long been recognized that there were negative effects for nearby neighborhoods, particularly in central cities. Today, many cities are mitigating some of the negative effects of freeways through expensive measures to cap or bury sections of freeway. Do these projects justify the costs? Could future infrastructure investments benefit from consideration of neighborhood disamenities? In this article, we summarize evidence of freeways' effects on quality of life and discuss the potential benefits of real-world policy interventions in Philadelphia.

Construction of the Interstate Highway System

Discussion of a national system of interstate highways, which had been gaining momentum since the 1930s, culminated with the signing of the Federal-Aid Highway Act of 1956 by President Eisenhower. This act authorized the construction of 41,000 miles of freeways over a 10-year period. To gain popular support for the highway system, Eisenhower emphasized

its advantages for national defense. However, the economic benefits were the primary motivation for supporters of the plan, and boosters of freeway construction touted the reduced transportation costs associated with freeways.[2] Mayors of major cities broadly supported construction, believing that new freeways would reduce congestion and improve the local economy.

Economic development was an important rationale for freeway construction, and while there are clear benefits for a region, the effects of freeways can be either positive or negative for an individual neighborhood. The new interstate system improved commerce and trade by connecting major cities and reducing travel times,[3] but as University of Toronto economist Nathaniel Baum-Snow shows, freeways also accelerated suburbanization and exacerbated the population decline in central cities. This population decline near downtowns was partially driven by reduced transportation costs that improved access and made suburban areas relatively more attractive. Freeways further worsened the decline by reducing the quality of life in central neighborhoods. As freeway construction began rapidly in the late 1950s, residents came to recognize these negative effects, and protests against construction appeared in most large U.S. cities.

Amenities for Some, Disamenities for Others

The construction of freeways brought broad changes to urban areas, but the costs and benefits of the freeways were not the same for all neighborhoods. When a freeway is built through a city, access to regional amenities such as job centers improves in neighborhoods near the freeway due to reduced travel times. This is particularly true for outlying areas located a long distance from the jobs and services that are often concentrated in central cities. Therefore, when freeways were constructed, neighborhoods in suburbs far from the central business district grew rapidly.

However, freeways also negatively affect the quality of life for nearby neighborhoods. These disamenities include noise, pollution, and barrier effects, whereby a newly constructed freeway limits access to amenities and services located on the other side of the freeway. For neighborhoods that do not benefit significantly from improved regional access, these negative effects can lead to neighborhood decline. For example, locations near central business districts already have access to jobs and other regional amenities and thus do not gain much from freeways. In these neighborhoods, the negative effects of freeways dominate, and the net result is population loss.

In a recent working paper, we provide evidence that freeways reduced the quality of life in nearby neighborhoods by looking at long-run changes in population and other variables. What we find is as expected: Suburban neighborhoods near freeways grew rapidly after freeways were constructed, while central neighborhoods near freeways declined. Using fine geographic data covering 1950 to 2010, we studied long-run changes in neighborhoods before and after the interstate highway system was built (Figure 1). We find that in the group of central-city neighborhoods closest to freeways, population declined by 32 percent, while in the group of central neighborhoods more than 2 miles from freeways, population actually grew by 56 percent.

Much of the negative effect on local amenities from freeways is due to barrier effects. Freeways often block local streets and limit the passthrough of cars and pedestrians. When a freeway cuts off a neighborhood from nearby amenities, the neighborhood becomes less desirable, and people relocate to other neighborhoods. Using data from historic travel surveys before and after freeways were constructed, we find that people were less likely to travel to the other side of a freeway locally, and if they did, the travel time was longer. In other words, although freeways improve overall regional access, they reduce access to nearby neighborhood amenities.[4] This research suggests that construction of the interstate highway system incurred significant external costs, and policymakers should consider these costs when assessing the value of urban freeway projects.

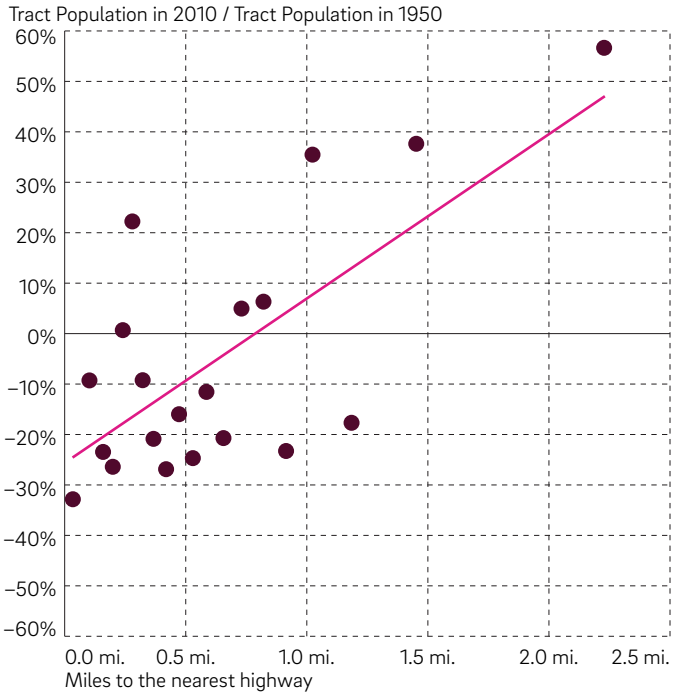
Quantifying Neighborhood Amenities

When measuring the effects of freeways, it is often hard to disentangle negative quality-of-life effects from the benefits accrued thanks to greater access to jobs and other regional resources. One way to identify quality-of-life amenities is to use proximity to a city's central business district as a proxy for job access before construction of the highway. But cities are more complex than suggested by that simple proxy. For example, cities often exhibit multiple job centers. For this reason, we prefer measures of job access that help us study cities with real-world geographies.

FIGURE 1

In Central Neighborhoods, Population Declines Are Greatest in Census Tracts Nearest to Freeways

Average population change, 1950–2010, in bins of neighborhoods within 2.5 miles of the city center, plotted against the distance to the closest freeway, for a sample of 2,312 neighborhoods in 64 metro areas in the U.S.



Sources: Brinkman and Lin (2019); U.S. Census Bureau.

An emerging literature in urban economics uses the spatial distribution of jobs, residences, land prices, and wages to separately quantify the value of locations for production (productivity) and the value of locations for consumption (residential amenities). The value of a residential location can arise from a variety of characteristics, including good schools, entertainment options, and natural amenities such as ocean views. Likewise, locations vary in their value for production due to natural advantages such as proximity to natural resources, or proximity to customers, suppliers, or employees. Finally, these locations are all connected, given that people consider the time and expense of traveling to work when choosing where to live. In addition, firms consider access to a pool of employees when considering where to locate. Since people can usually choose where to live and where to work, the spatial distributions of population and employment in cities provide evidence of the value of locations for different activities.

Employment and residences are distributed very differently within urban areas. This suggests that locations vary in their value for production versus residential uses. We find that there is an extremely high density of jobs in the central business district of Philadelphia, with employment densities exceeding 200,000 jobs per square mile for several census tracts (Figure 2, top panel). Jobs are highly concentrated in the central business district even though land prices there are extremely high. It is common for per-acre land prices in American cities to be at least 10 times higher in the central business district than in suburbs just 10 miles away.[5] The concentration of jobs and the willingness to pay such high prices is clear evidence that business districts provide advantages for the production of goods and services. Researchers have shown that these efficiencies can arise from access to a pool of employees, input sharing, and information spillovers (that is, information about one thing generating information about seemingly unrelated things).[6]

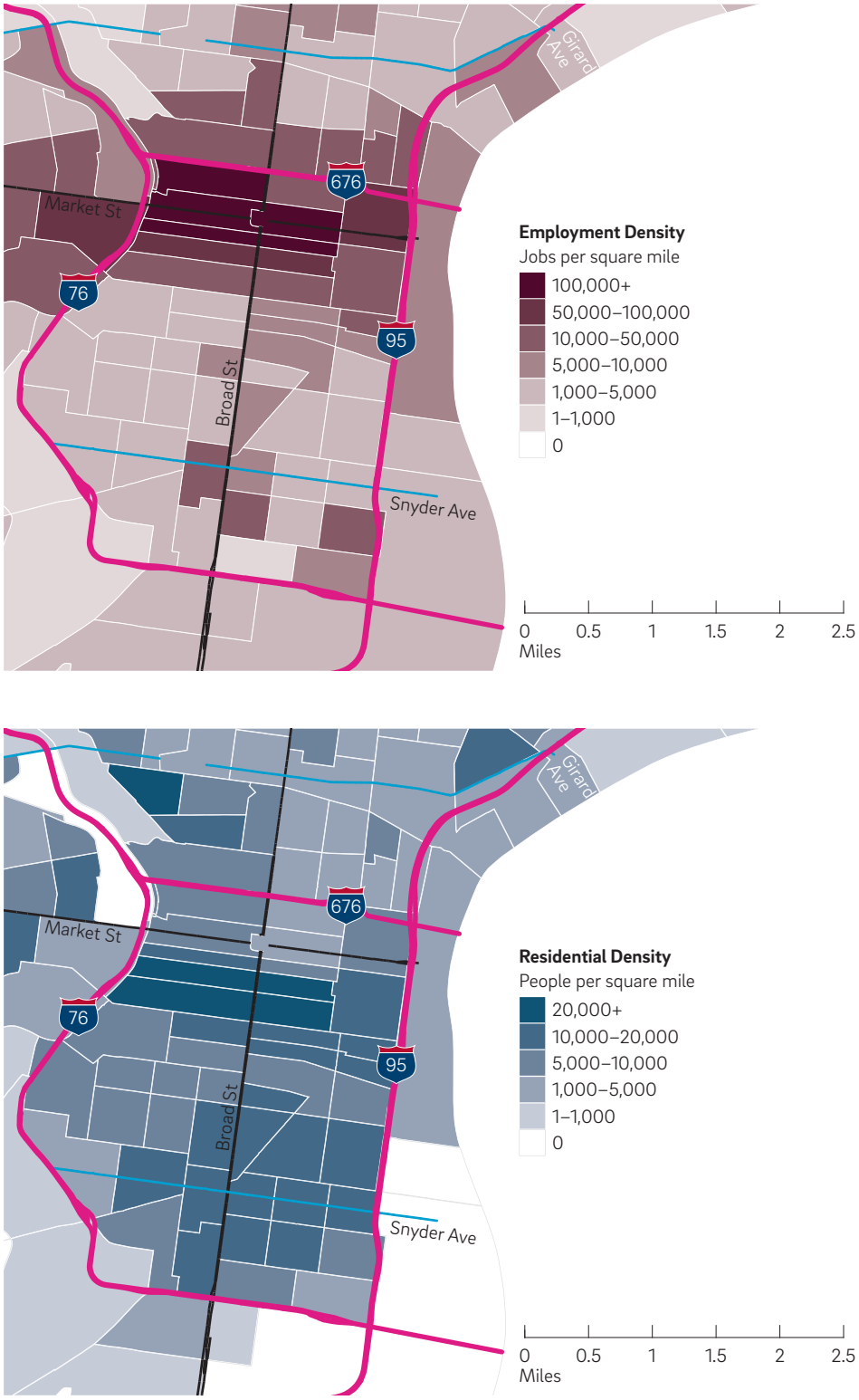
However, although residences are not as spatially concentrated as jobs, there are still big differences in density across space (Figure 2, bottom panel). For example, the neighborhoods directly south of the

FIGURE 2

Many People Highly Value Living Near Jobs

Jobs are very dense in the central business district, and many residents live near those jobs.

Employment density (top panel) and employed residential population density (bottom panel) for census tracts in central Philadelphia on the same scale, 2000.



Sources: Brinkman and Lin (2019); American Association of State Highway and Transportation Census Transportation Planning Products (CTPP) program; U.S. Census Bureau.

central business district exhibit residential population densities as high as 25,000 employed workers per square mile. Again, given that these locations are also very expensive, it is clear that people particularly value living in these locations. Less obvious is whether they derive this value from proximity to jobs or from residential amenities.

Recently, some economists have developed quantitative models to disentangle how much people value different characteristics of a location, including access to jobs and residential amenities.[7] By using the observed spatial distribution of jobs and workers, and also by incorporating information on rents, wages, and travel times between locations, these economists can identify the mechanisms that guide the spatial layout of cities and the colocation patterns of firms and workers in cities. In particular, their models separate the value of job access from the quality-of-life benefits of neighborhoods. These models also allow for the analysis of real-world policies. For example, Philadelphia Fed economist Christopher Severen uses one such model to study the effects of subway construction in Los Angeles. By using such a model for our working paper, we find that the quality-of-life effects of freeways play an important role in decentralization and significantly affect overall welfare.

Mitigating Freeway Disamenities

Many cities have implemented or considered projects to mitigate disamenity effects by burying or capping freeways through city centers. The goal of these projects is to reconnect streets and neighborhoods, reduce noise, and reclaim land for other urban uses. These projects continue to move forward despite high construction costs. Costs vary depending on project details but can range from $300 million to $700 million per mile of freeway. Freeway construction costs have increased drastically since construction of the interstate system.[8] Therefore, it is important to know whether the benefits of these projects are worth the costs.

In Philadelphia, several projects have partially capped small parts of freeways. Parts of I-676 though Center City were partially capped to create small parks near the Benjamin Franklin Parkway, the scenic, tree-lined boulevard connecting City Hall with the Philadelphia Museum of Art. The costs were modest given that the freeway was already below grade, and construction was done as part of a project to reconstruct existing bridges crossing the freeway. Another project would extend an already existing cap over I-95, which closely follows the Delaware River through the city, to better connect the city to the riverfront. The new project covers only an additional one-tenth of a mile of freeway but involves development of a large urban park. Despite this improvement, large sections of the Philadelphia waterfront will remain cut off by I-95. When the freeway was first built, much of the waterfront was a declining industrial zone. Planners saw this zone as the logical route for the new north/south interstate through Philadelphia. However, 60 years later, the Philadelphia waterfront remains underutilized, and I-95 is the obvious obstacle preventing redevelopment.

We estimate the benefits of a more ambitious project that would reconnect a much larger portion of central Philadelphia to the Delaware River waterfront (Figure 3). Using quantitative methods developed in urban economics, we simulate the effects of burying a section of I-95 from Snyder Avenue to Girard Avenue. This roughly 4.5-mile stretch of freeway starts in South Philly and traverses the riverfront neighborhoods of Pennsport, Queen Village, Society Hill, Old City, Northern Liberties, and Fishtown. The proximity of these neighborhoods to the central business district and their high population density suggest that this might be an ideal setting for such an intervention.

We conduct the analysis using data on the location of population and employment, as well as data on commuting travel times between locations. We input these data into a quantitative model to estimate the amenities and productivities of different neighborhoods. Intuitively, amenities are estimated through the model by comparing neighborhoods in terms of job access and population density. If a neighborhood has superior job access but low population density, this is evidence of fewer amenities. For Philadelphia, we find that neighborhood amenity values are roughly 11 percent lower immediately next to a freeway compared to locations far away. In addition, these effects decline but persist out to at least a mile from a freeway. In other words, people would be willing to pay roughly 11 percent of their income to avoid living directly next to a freeway, holding everything else constant (including access to jobs). In analysis conducted for a recent working paper, we find an even larger effect of 17 percent in Chicago. These estimates suggest that negative quality-of-life effects from freeways are quantitatively important.

Next, we use these estimates of disamenities and quantitative modeling techniques to analyze the effect of burying I-95 in central Philadelphia. We simulate a counterfactual economy where the transportation benefits of the freeway remain but the negative effects to nearby neighborhoods would be fully mitigated. The improvement to nearby neighborhoods would be accomplished by reconnecting streets, reducing noise and pollution, and reclaiming land for other uses. We do not consider removing the freeway altogether, given that this would require calculating changes in travel patterns throughout the region. This is harder to simulate, but techniques have been developed to account for the effect of changes in transport networks on travel. Removal of the freeway would likely have muted benefits relative to the mitigation experiment we present here.

The first result of the experiment is that population near the freeway increases drastically, with population densities of employed individuals in neighborhoods near the freeway increasing by as much as 2,840 people per square mile after the intervention. Overall, for neighborhoods within one mile of the freeway project, population increases by 7 percent in this scenario. Land prices in these same neighborhoods increase by 2.4 percent.

With this simulation, we can roughly estimate the benefits of such a project. The simulation provides an estimate of the overall increase in welfare for the entire regional population. This benefit is derived from the improved amenities in neighborhoods near the freeway project, and it accounts for general equilibrium effects that lead to changes in population and employment throughout the city. Overall, we find that this project alone leads to the quality-of-life equivalent of a 0.05 percent increase in income, or roughly $245 million every year for the entire Philadelphia metropolitan area. Using a discount rate of 7 percent,

this suggests the total lifetime value for the project is around $3.5 billion.[9] This notable result shows that the benefits of these projects are on the same order of magnitude as the costs. Projects of this sort often cost around $500 million per mile, so the total cost of this project is around $2.25 billion. Based on these rough estimates, this particular project would pass a cost-benefit test.

A project like this could be funded using general tax revenue from the city, state, or federal government. However, the benefits of the project would accrue mostly to the surrounding neighborhoods. New York University professor of finance Arpit Gupta and his coauthors find that the Second Avenue subway in New York created value for nearby property owners in excess of the construction costs. Improvements in local amenities are capitalized into higher property prices. This suggests that a targeted tax or assessment could be used to finance improvements such as the one proposed here.[10]

There is significant uncertainty surrounding these estimates. These results are conservative estimates of quality-of-life benefits. The results change depending on the assumptions, modeling choices, and setting. In particular, estimates of parameters that describe how people value neighborhood amenities vary in the existing literature yet have significant effects on welfare calculations. If we use values at the high end of existing estimates, the benefits of mitigation can increase by 100 percent, whereas low-parameter estimates can reduce the benefits by about 30 percent. Additional work and more development of quantitative modeling would improve the precision of these estimates. Nonetheless, negative quality-of-life effects are quantitatively important, and targeted projects like the ones being proposed or implemented in cities all over the U.S. may provide important benefits for central cities.

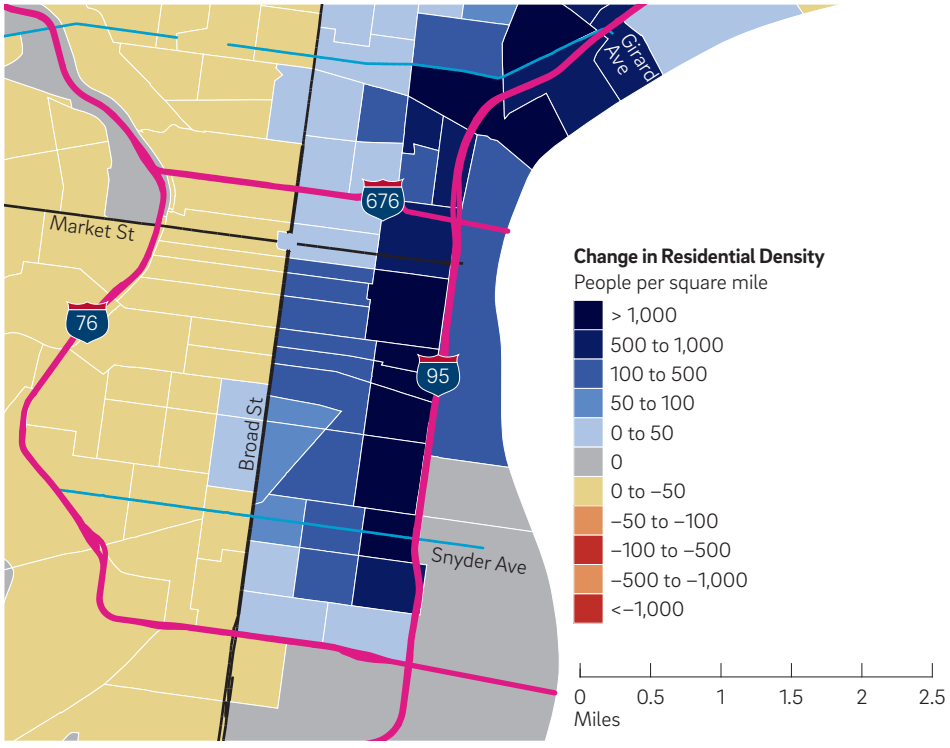
Conclusion

Economic development was an important rationale for freeway construction, but not everyone benefited from the new freeways. That's because freeways bring amenities to some neighborhoods by increasing access but disamenities to others by reducing the quality of life. Using techniques developed in recent economic research, we can quantify neighborhood amenities and thus the costs and benefits of freeway construction for individual neighborhoods and for an entire metro area. Many cities, including Philadelphia, could benefit from mitigation of freeway disamenities by covering or capping central city highways.

FIGURE 3

Burying a Portion of I-95 in Philadelphia Would Likely Lead to a Population Boom in Neighboring Census Tracts

Change in employed residential population density for census tracts in central Philadelphia if negative neighborhood effects were mitigated for I-95.



Source: Authors' calculations; U.S. Census Bureau.

Notes

1 "Freeway" generally refers to a limited-access highway built for high-speed automobile travel. We use the terms "freeway" and "highway" interchangeably to refer to these types of limited-access roads.

2 See Weingroff (1996) for an extensive history of highway building in the U.S.

3 See Duranton, Morrow, and Turner (2014).

4 Highways reduce the quality of life through other margins, too—for example, noise or pollution. Given the extensive literature estimating these effects, we don't attempt to quantify them. But the spatial scale of barrier effects seems to exceed the spatial scale of noise or pollution effects by a large degree.

5 Haughwout et al. (2008) find that average land prices in Manhattan can be hundreds of times higher per square foot than in suburban locations just 30 miles away.

6 For more on this topic, see Carlino (2011).

7 See, for example, Ahlfeldt et al. (2015).

8 See Brooks and Liscow (2019).

9 A discount rate is used to calculate the present value of a project that will have benefits in the future. The federal Office of Management and Budget recommends using a discount rate of 7 percent for public infrastructure investments, although state transportation departments often use lower values, which increases the estimated benefits of a project.

10 Gupta, Van Nieuwerburgh, and Kontokosta (2022) study value capture and the potential of targeted property taxes.

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