

# Synthetic data holds the key to determining best statewide transit investments

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Synthetically generated population data can reveal the equity impacts of distributing transportation resources and funding across diverse regions, according to new research from NYU's Tandon School of Engineering that uses New York State as a case study.

Relying on an artificial dataset representing 19.5 million New York residents and over 120,000 modeled origin-destination trips, researchers from NYU Tandon's C2SMARTER, a Tier 1 University Transportation Center, determined how best to invest in [transportation services](#) when equitable benefits are an objective.

They presented the findings in a paper [published](#) in *Transportation Research Part D: Transport and Environment*.

"Policymakers often use surveys to allocate transportation resources, but these surveys frequently underrepresent [low-income](#) and marginalized communities," said Joseph Chow, Institute Associate Professor of Civil and Urban Engineering, who led the study. "We developed a completely new approach for transportation planning, showing that synthetic data can consistently assess equity impacts across large regions like New York State. Our statewide model parameters are available to any agency to study the multiple effects of new service designs, something previously impossible."

The research team developed what they call an "equity-aware choice-based decision support tool."

Given a budget level, the proposed tool selects optimal service regions for one or two new mobility services considering four objectives: (1) maximizing total revenue, (2) maximizing total increased consumer surplus, meaning delivering consumers cost savings (3) minimizing consumer surplus disparity, meaning making the benefits fair between different groups and (4) minimizing consumer surplus insufficiency, meaning ensuring baseline benefits even in areas that are less profitable.

The first two objectives focus on making the transportation system more efficient and profitable overall. The last two objectives emphasize making sure the benefits are distributed more equitably among different

consumer groups and regions.

Using the tool with New York State synthetic data, researchers focused on two hypothetical mobility services: ride-hailing services that offer shorter travel times but higher trip fares, and on-demand microtransit services that provide longer travel times with lower trip fares. The results showed that:

- Investing mostly in ride-hailing services, focusing on longer trips in [metropolitan areas](#) like New York City, maximized revenue.
- Also prioritizing ride-hailing services but covering shorter trips in metropolitan areas maximized consumer surplus.
- Investing mainly in on-demand microtransit service, targeting disadvantaged communities, minimized consumer surplus disparity,
- Splitting the budget between ride-hailing and microtransit services, covering both urban and rural areas, balanced equity and efficiency.

"Microtransit played an outsized role boosting equity, proving more viable in disadvantaged areas. But it needed subsidies to offset lower productivity than ride-hailing," said Chow, who is also Deputy Director of C2SMARTER. "We hope this study is a step towards creating a way to analyze and allocate transportation resources nationally, to produce equitable outcomes throughout the U.S.

Replica, a transportation data and analytics firm, provided the synthetic data for the study. The dataset combines real mobility, demographic, and built environment information with mathematical models, providing details like travel demand patterns, transportation network characteristics, and mode choices for a given region.

"The work Dr. Chow and the team at NYU Tandon are doing is precisely

what we had in mind when making Replica data available," said Robert Regué, Director of Research and Development at Replica. "We believe [synthetic data](#) is the key to taking a more data-driven approach to creating more equitable, sustainable, and economically resilient cities, while protecting personal privacy. We are always excited to see our data contribute to such thoughtful, impactful research."

**More information:** Xiyuan Ren et al, Mobility service design with equity-aware choice-based decision-support tool: New York case study, *Transportation Research Part D: Transport and Environment* (2024). DOI: [10.1016/j.trd.2024.104255](https://doi.org/10.1016/j.trd.2024.104255)

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