

The accessibility and inaccessibility of urban public charging station

Hossein Gazmeh¹, Xinwu Qian^{1,*}, Mario L. Small², Qi Wang³, and Yuntao Guo⁴

¹Department of Civil and Environmental Engineering, Rice University, Houston, TX

²Department of Sociology, Columbia University, New York, NY

³Department of Civil and Environmental Engineering, Northeastern University, Boston, MA

⁴School of Traffic and Transportation Engineering, Tongji University, Shanghai, China

*xinwu.qian@rice.edu

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1 Data

Our primary datasets include information on public charging station locations from the Department of Energy’s Alternative Fuels Data Center (AFDC)¹, publicly available and covering over 65,000 stations as of January 2024. Sociodemographic data were collected from the American Community Survey 2021 5-year estimates², detailing income, race/ethnicity, education, and residential status for over 329 million Americans at the Census Block Group (CBG) level. Further, nationwide activity locations and mobility patterns were sourced from SafeGraph’s Global Points of Interest (POIs) dataset³ and Advan Monthly Pattern dataset⁴, part of a Dewey Data Marketplace subscription, encompassing over 18.5 million places as of January 2024, classified by more than 600 NAICS codes and 250 major categories.

1.1 Metropolitan Areas

Metro areas are defined according to the U.S. Census delineations of a Metropolitan Statistical Area (MSA)⁵, with boundaries collected from the 2020 Census TIGER Shapefiles⁶. Table S1 displays the metro areas’ shortened names and their Census delineations of MSA.

Full Name	Abbreviation	Number of Stations	EVSEs
Albany–Schenectady, NY	Albany, NY	611	1676
Atlanta, GA	Atlanta, GA	1401	3624
Austin, TX	Austin, TX	753	1757
Baltimore, MD	Baltimore, MD	738	2130
Boston, MA–NH	Boston, MA	2127	5013
Chicago, IL–IN	Chicago, IL	967	2511
Dallas–Fort Worth–Arlington, TX	Dallas, TX	820	2049
Denver–Aurora, CO	Denver, CO	817	2197
Kansas City, MO–KS	Kansas City, KS	967	1950
Los Angeles–Long Beach–Anaheim, CA	Los Angeles, CA	5232	13957
Miami–Fort Lauderdale, FL	Miami, FL	1279	3768
New York–Jersey City–Newark, NY–NJ	New York, NY	2221	6509
Philadelphia, PA–NJ–DE–MD	Philadelphia, PA	814	2138
Phoenix–Mesa–Scottsdale, AZ	Phoenix, AZ	758	1977
Sacramento, CA	Sacramento, CA	660	1973
San Diego, CA	San Diego, CA	1297	3601
San Francisco–Oakland, CA	San Francisco, CA	2451	6141
San Jose, CA	San Jose, CA	1726	4884
Seattle–Tacoma, WA	Seattle, WA	1412	3615
Washington–Arlington, DC–VA–MD	Washington, DC	1711	4951

Table S1. Table of Metro Areas with Abbreviations, Number of Stations, and Number of Chargers

1.2 American Community Survey Detailed Tables

The socioeconomic and demographic data on the census block groups were obtained from the American Community Survey 2021 5-year estimates². Table S2 shows the used detailed tables and features collected from the dataset.

Table Code	Feature Name	Table Description
B02001	White %	Percentage of individuals within a census block group who list their racial status as White alone
B02001	Black %	Percentage of individuals within a census block group who list their racial status as Black or African American alone
B02001	Asian %	Percentage of individuals within a census block group who list their racial status as Asian alone
B02001	Hispanic %	Percentage of individuals within a census block group who list their racial status as Hispanic or Latino origin
B19013	Median Household Income	Median household income (\$) in the past 12 months (in inflation-adjusted dollars)
B25032	Rental Housing Units	Percentage of renter-occupied housing units
B25075	Housing Value	Value of owner-occupied housing units (\$)

Table S2. Detailed Tables from American Community Survey

1.3 Filtering Points of Interest

We applied multiple filtering steps to the SafeGraph Points of Interest (POIs) dataset to ensure relevance to charging station activity, following the similar steps described in⁷. Initially, we excluded seven high-level business categories defined by the North American Industry Classification System (NAICS)⁸, including ‘Administrative and Support and Waste Management and Remediation Services,’ ‘Agriculture, Forestry, Fishing and Hunting,’ ‘Mining, Quarrying, and Oil and Gas Extraction,’ ‘Management of Companies and Enterprises,’ ‘Utilities,’ ‘Construction,’ and ‘Manufacturing,’ which collectively represented 7.5% of the total POIs. Further refinement was achieved by excluding locations with a median dwell time over 5 hours or less than 10 minutes, using SafeGraph’s spend patterns dataset⁹. This excluded categories such as ‘Financial Transactions Processing, Reserve, and Clearinghouse Activities’ and ‘Petroleum Bulk Stations and Terminals’. We also removed high-count POIs that did not facilitate charging activities, such as ATMs and in-store services like Redbox vending machines, USPS Collection Points, UPS Drop Boxes, Allpoint ATMs, and Redbox locations. Additionally, to avoid redundancy, we filtered out alternative fuel stations, including ‘Other Gasoline Stations’ and brands like ‘ChargePoint Network Charging Station,’ ‘EVgo,’ ‘Tesla Destination Charger,’ and ‘Blink Charging Co.’. We display the remaining NAICS high-level categories and their corresponding SafeGraph top categories in Table S3. Moreover, Table S4 shows the number of remaining POIs across the categories in the metro areas.

NAICS Code	NAICS Category	SafeGraph Top Categories
	Accommodation and Food Services	‘Restaurants and Other Eating Places’, ‘Drinking Places (Alcoholic Beverages)’, ‘Traveler Accommodation’, ‘Special Food Services’, ‘RV (Recreational Vehicle) Parks and Recreational Camps’, ‘Rooming and Boarding Houses, Dormitories, and Workers Camps’

Retail and Wholesale Trade

'Book Stores and News Dealers', 'Grocery Stores', 'Electronics and Appliance Stores', 'Health and Personal Care Stores', 'Specialty Food Stores', 'Clothing Stores', 'General Merchandise Stores, including Warehouse Clubs and Supercenters', 'Other Miscellaneous Store Retailers', 'Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers', 'Machinery, Equipment, and Supplies Merchant Wholesalers', 'Sporting Goods, Hobby, and Musical Instrument Stores', 'Gasoline Stations', 'Beer, Wine, and Liquor Stores', 'Building Material and Supplies Dealers', 'Home Furnishings Stores', 'Furniture Stores', 'Florists', 'Other Motor Vehicle Dealers', 'Clothing and Clothing Accessories Stores', 'Jewelry, Luggage, and Leather Goods Stores', 'Shoe Stores', 'Office Supplies, Stationery, and Gift Stores', 'Department Stores', 'Automobile Dealers', 'Automotive Parts, Accessories, and Tire Stores', 'Drugs and Druggists', 'Sundries Merchant Wholesalers', 'Vending Machine Operators', 'Furniture and Home Furnishings Stores', 'Miscellaneous Store Retailers', 'Lawn and Garden Equipment and Supplies Stores', 'Used Merchandise Stores', 'Miscellaneous Durable Goods Merchant Wholesalers', 'Household Appliances and Electrical and Electronic Goods Merchant Wholesalers', 'Chemical and Allied Products Merchant Wholesalers', 'Lumber and Other Construction Materials Merchant Wholesalers', 'Direct Selling Establishments', 'Professional and Commercial Equipment and Supplies Merchant Wholesalers', 'Grocery and Related Product Merchant Wholesalers', 'Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers', 'Petroleum and Petroleum Products Merchant Wholesalers', 'Metal and Mineral (except Petroleum) Merchant Wholesalers', 'Food and Beverage Stores', 'Miscellaneous Nondurable Goods Merchant Wholesalers', 'Electronic Shopping and Mail-Order Houses'

Health Care and Social Assistance

'Offices of Physicians', 'Offices of Other Health Practitioners', 'Offices of Dentists', 'Child Day Care Services', 'Medical and Diagnostic Laboratories', 'Outpatient Care Centers', 'General Medical and Surgical Hospitals', 'Individual and Family Services', 'Specialty (except Psychiatric and Substance Abuse) Hospitals', 'Nursing and Residential Care Facilities', 'Other Ambulatory Health Care Services', 'Community Food and Housing, and Emergency and Other Relief Services', 'Home Health Care Services', 'Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly', 'Nursing Care Facilities (Skilled Nursing Facilities)', 'Social Assistance', 'Hospitals', 'Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities', 'Ambulatory Health Care Services', 'Psychiatric and Substance Abuse Hospitals'

Arts, Entertainment, and Recreation

'Other Amusement and Recreation Industries', 'Museums, Historical Sites, and Similar Institutions', 'Amusement Parks and Arcades', 'Promoters of Performing Arts, Sports, and Similar Events', 'Performing Arts Companies', 'Independent Artists, Writers, and Performers', 'Spectator Sports', 'Gambling Industries', 'Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures', 'Arts, Entertainment, and Recreation'

Professional, Scientific, and Technical and Educational Services	‘Specialized Design Services’, ‘Legal Services’, ‘Elementary and Secondary Schools’, ‘Accounting, Tax Preparation, Bookkeeping, and Payroll Services’, ‘Architectural, Engineering, and Related Services’, ‘Management, Scientific, and Technical Consulting Services’, ‘Other Professional, Scientific, and Technical Services’, ‘Other Schools and Instruction’, ‘Junior Colleges’, ‘Technical and Trade Schools’, ‘Advertising, Public Relations, and Related Services’, ‘Colleges, Universities, and Professional Schools’, ‘Computer Systems Design and Related Services’, ‘Educational Services’, ‘Scientific Research and Development Services’, ‘Business Schools and Computer and Management Training’, ‘Educational Support Services’
Public Administration and Other Services	‘Religious Organizations’, ‘Personal Care Services’, ‘Drycleaning and Laundry Services’, ‘Justice, Public Order, and Safety Activities’, ‘Other Personal Services’, ‘Electronic and Precision Equipment Repair and Maintenance’, ‘Automotive Repair and Maintenance’, ‘Executive, Legislative, and Other General Government Support’, ‘Death Care Services’, ‘Personal and Household Goods Repair and Maintenance’, ‘Civic and Social Organizations’, ‘Grantmaking and Giving Services’, ‘Administration of Economic Programs’, ‘Administration of Human Resource Programs’, ‘Social Advocacy Organizations’, ‘Business, Professional, Labor, Political, and Similar Organizations’, ‘Religious, Grantmaking, Civic, Professional, and Similar Organizations’, ‘Repair and Maintenance’, ‘National Security and International Affairs’, ‘Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance’
Real Estate and Rental and Leasing	‘Lessors of Real Estate’, ‘Automotive Equipment Rental and Leasing’, ‘General Rental Centers’, ‘Offices of Real Estate Agents and Brokers’, ‘Real Estate’, ‘Consumer Goods Rental’, ‘Activities Related to Real Estate’, ‘Commercial and Industrial Machinery and Equipment Rental and Leasing’
Finance, Insurance, and Information	‘Wired and Wireless Telecommunications Carriers’, ‘Other Financial Investment Activities’, ‘Sound Recording Industries’, ‘Activities Related to Credit Intermediation’, ‘Other Information Services’, ‘Radio and Television Broadcasting’, ‘Telecommunications’, ‘Nondepository Credit Intermediation’, ‘Depository Credit Intermediation’, ‘Insurance Carriers’, ‘Motion Picture and Video Industries’, ‘Finance and Insurance’, ‘Newspaper, Periodical, Book, and Directory Publishers’, ‘Data Processing, Hosting, and Related Services’, ‘Cable and Other Subscription Programming’, ‘Software Publishers’, ‘Securities and Commodity Contracts Intermediation and Brokerage’, ‘Insurance Carriers and Related Activities’, ‘Other Investment Pools and Funds’, ‘Other Telecommunications’, ‘Broadcasting (except Internet)’, ‘Insurance and Employee Benefit Funds’

Transportation and Warehousing	'Urban Transit Systems', 'Warehousing and Storage', 'Support Activities for Water Transportation', 'Specialized Freight Trucking', 'Taxi and Limousine Service', 'Interurban and Rural Bus Transportation', 'Transit and Ground Passenger Transportation', 'Support Activities for Road Transportation', 'Scenic and Sightseeing Transportation', 'Support Activities for Air Transportation', 'Rail Transportation', 'Freight Transportation Arrangement', 'Other Transit and Ground Passenger Transportation', 'Scheduled Air Transportation', 'Deep Sea, Coastal, and Great Lakes Water Transportation', 'General Freight Trucking', 'Other Support Activities for Transportation', 'Water Transportation', 'Scenic and Sightseeing Transportation, Land'
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Table S3. NAICS Categories and SafeGraph Top Categories

Metro Area	Transportation and Warehousing	Health Care and Social Assistance	Retail and Wholesale Trade	Professional, Scientific, Technical and Educational Services	Accommodation and Food Services	Finance, Insurance and Information	Real Estate and Rental and Leasing	Public Administration and Other Services	Arts, Entertainment, and Recreation	Total
Albany, NY	2714	10747	4699	2131	3390	645	4599	4495	1056	34476
Atlanta, GA	21543	74953	39580	19932	26011	6672	26967	43109	8430	267197
Austin, TX	3849	29606	13608	7680	11091	2702	12280	14234	4346	99396
Baltimore, MD	13463	45302	15724	7390	10613	2398	15974	15862	3623	130349
Boston, MA	14150	102875	32020	18263	21104	4807	75181	32100	13877	314377
Chicago, IL	40619	150881	58393	34731	42115	10853	70506	59631	17456	485185
Dallas, TX	16860	81620	44125	19507	29922	7795	24381	46327	9047	279584
Denver, CO	9803	55262	20211	10897	13425	3994	16227	20852	6245	156916
Kansas City, KS	5703	28112	11813	5800	7428	2144	7524	11796	3207	83527
Los Angeles, CA	38373	213588	120073	55627	78512	18527	119847	113612	23953	782112
Miami, FL	26738	106804	59605	30139	36919	8801	76079	51496	12623	409204
New York, NY	54341	332698	160978	74660	119330	22653	120631	138279	31304	1054874
Philadelphia, PA	22686	115677	41868	20523	27786	6024	36937	39521	9821	320843
Phoenix, AZ	9856	63346	28030	13641	18136	5228	17075	29004	6491	190807
Sacramento, CA	5546	30592	13496	6967	8621	2640	8062	15168	3666	94758
San Diego, CA	8248	59159	25792	14825	18613	4831	23114	27610	7945	190137
San Francisco, CA	16376	78657	29828	19164	26755	5084	34001	30739	10218	250822
San Jose, CA	5767	36445	11895	7436	10694	2449	12268	13596	3836	104386
Seattle, WA	14655	83988	24206	12699	19426	4336	20319	25002	7616	212247
Washington, DC	35462	86456	30315	23277	25055	5574	40801	35339	9621	291900

Table S4. Number of POIs in selected Metro Areas

1.4 Extracting Mobility Patterns

The mobility patterns of interest in our study are the number of visits from Census Block Groups (CBGs) to Points of Interest (POIs). The data, sourced from the Advan monthly patterns dataset⁴, was aggregated over 12 months since January 2023 and includes data from 35 million cell phones in North America. This dataset is compatible with SafeGraph PLACEKEYs, and CBGs are matched with the ACS dataset using their GEOIDs. For each covered POI, it includes information such as raw counts of visits to POIs, median dwell times (in minutes), and visitors' home neighborhoods. Home location is determined by computing the time a device spent in each building and identifying the most frequented building as the home/work (night/day) location. Table S5 shows the percentage of the locations with visitor data compared to all available POIs from the SafeGraph dataset as a measure of representativity. Table S6 shows the average daily visits per place for different categories.

Metro Area	Transportation and Warehousing	Health Care and Social Assistance	Retail and Wholesale Trade	Professional, Scientific, Technical and Educational Services	Accommodation and Food Services	Finance, Insurance and Information	Real Estate and Rental and Leasing	Public Administration and Other Services	Arts, Entertainment, and Recreation	Total
Albany, NY	6.52	26.18	64.61	74.19	60.44	68.84	12.22	62.54	62.12	40.99
Atlanta, GA	10.37	32.61	65.65	74.39	65.79	69.65	29.0	65.08	63.95	48.85
Austin, TX	17.59	31.74	66.93	74.13	62.94	73.21	29.67	66.69	68.09	50.23
Baltimore, MD	6.29	24.83	64.56	73.63	63.66	70.27	16.79	65.6	62.57	39.5
Boston, MA	13.87	18.67	63.72	76.46	62.83	73.25	6.79	64.93	69.41	34.32
Chicago, IL	8.74	26.64	65.31	78.48	62.81	68.7	13.14	66.76	72.07	42.19
Dallas, TX	12.86	30.56	66.72	73.77	65.94	70.4	30.9	65.94	66.45	50.17
Denver, CO	10.98	25.45	67.83	75.84	65.01	73.76	28.4	67.23	69.75	45.74
Kansas City, KS	8.52	25.68	67.71	76.22	65.37	73.51	24.96	63.95	63.21	45.5
Los Angeles, CA	14.56	30.77	64.22	78.21	63.69	71.87	16.76	71.97	68.6	47.76
Miami, FL	15.12	31.22	64.66	75.87	60.26	71.57	15.92	67.65	67.11	44.66
New York, NY	16.88	30.53	59.07	77.73	59.88	62.21	15.08	66.2	65.24	45.46
Philadelphia, PA	6.85	26.86	62.59	74.95	62.04	69.36	15.28	64.08	62.53	41.37
Phoenix, AZ	12.38	33.1	66.84	76.48	66.66	74.01	39.81	69.21	64.43	51.55
Sacramento, CA	11.99	29.33	67.8	77.61	67.06	74.2	39.53	69.7	70.21	50.94
San Diego, CA	17.45	27.73	65.9	77.15	63.7	73.28	26.75	71.06	69.5	48.91
San Francisco, CA	13.18	28.1	64.58	77.48	61.32	70.59	16.31	70.21	70.92	44.95
San Jose, CA	13.23	28.41	63.99	76.64	62.35	68.76	23.17	68.95	70.59	45.7
Seattle, WA	10.17	22.44	65.17	74.62	63.26	73.29	24.37	65.37	69.01	41.27
Washington, DC	6.01	30.59	65.18	77.38	62.21	68.68	17.35	66.1	68.86	42.08

Table S5. Percentage of Mobility Coverage of POIs in the Metro Areas

Metro Area	Transportation and Warehousing	Health Care and Social Assistance	Retail and Wholesale Trade	Professional, Scientific, Technical and Educational Services	Accommodation and Food Services	Finance, Insurance and Information	Real Estate and Rental and Leasing	Public Administration and Other Services	Arts, Entertainment, and Recreation	Total
Albany, NY	6.95	5.3	10.39	6.59	8.39	5.31	34.73	4.37	24.86	8.9
Atlanta, GA	28.57	9.55	20.65	10.2	23.56	10.91	45.48	8.1	29.3	16.7
Austin, TX	10.87	8.61	16.48	12.81	16.74	10.54	30.36	8.81	21.94	14.18
Baltimore, MD	15.65	7.73	19.3	9.19	15.29	13.09	30.93	7.7	25.33	13.44
Boston, MA	15.0	9.45	14.01	10.67	13.62	11.96	21.06	5.98	23.18	12.27
Chicago, IL	17.68	11.34	19.52	17.27	16.92	11.73	37.36	7.98	28.64	16.09
Dallas, TX	12.39	13.68	19.11	12.35	18.35	12.15	45.72	9.21	32.05	16.8
Denver, CO	9.52	7.06	16.1	7.78	15.83	8.87	25.28	6.77	22.65	12.11
Kansas City, KS	7.99	11.99	27.65	8.83	22.38	9.21	59.75	8.09	41.77	19.25
Los Angeles, CA	10.62	4.73	7.82	4.43	8.05	5.53	15.99	3.87	36.84	7.72
Miami, FL	14.34	10.61	16.28	11.72	14.91	11.7	24.94	8.92	20.18	13.66
New York, NY	14.11	8.95	15.89	12.37	12.14	15.55	26.46	7.13	29.71	12.71
Philadelphia, PA	14.58	8.69	13.17	10.02	12.16	8.87	33.05	5.39	26.71	11.49
Phoenix, AZ	18.31	7.0	22.43	8.55	21.91	10.52	35.11	10.19	30.82	15.82
Sacramento, CA	7.39	6.8	12.64	6.36	12.95	6.21	30.19	5.52	30.39	11.1
San Diego, CA	9.83	6.5	11.48	6.33	10.91	7.54	19.83	5.63	26.15	9.91
San Francisco, CA	9.04	5.93	9.13	4.86	8.17	7.07	12.55	4.55	16.44	7.49
San Jose, CA	12.43	5.39	12.45	5.92	11.05	7.03	17.8	5.8	25.58	9.51
Seattle, WA	19.39	7.63	16.72	9.11	12.72	9.11	20.61	6.16	26.76	12.0
Washington, DC	21.64	8.11	15.04	10.91	15.7	10.78	27.96	7.2	29.5	13.04

Table S6. Average recorded daily visits to covered places

1.5 Selection of POI Categories

To analyze the association between public charging stations (PCS) and activity places, we identified specific categories of points of interest (POIs) using the “top category” and “sub-category” attributes from the SafeGraph POI dataset. The selection process followed a stepwise approach to ensure the inclusion of relevant and meaningful categories.

First, we extracted the full list of POI categories, which initially consisted of 330 subcategories grouped under 146 top categories. To avoid ambiguity, we renamed the subcategory *Gasoline Stations with Convenience Stores*, which includes convenience store chains, to *Convenience Stores*. Next, to assess the relevance of each category for PCS analysis, we calculated two scores. The first score, PCS Coverage, measured the percentage of POIs in each category with at least one public charging station within a 0.25 km radius. A minimum threshold of 10% was applied to ensure that selected categories are frequently proximate to charging infrastructure. The second score, Visit Ratio, measured the percentage of visits to POIs in each category that were near a PCS relative to all visits in the category. We applied a similar 10% threshold to focus on categories where PCS proximity significantly influences visitation patterns. Additionally, categories with fewer than 3,000 POIs were excluded to eliminate small or sparsely populated categories. This filtering process reduced the initial list to 126 categories.

To ensure that the remaining categories reflect general-purpose activity locations visited regularly by a broad segment of the population, we removed categories with highly specialized uses, such as “Offices of Lawyers,” “Golf Courses and Country Clubs,” and “Offices of Optometrists.” The remaining categories were then sorted based on their Visit Ratio and PCS Coverage scores, and the top 10 categories were selected for further analysis to ensure that the selected categories are both relevant to PCS proximity and broadly representative of routine activity places. Table S7 provides a summary of the final 10 categories, including their names, descriptions, and representative brands.

Description	PCS Coverage	Visit Ratio	# Locations	Sample Brands
Warehouse Clubs and Supercenters	0.24	0.47	3,127	Walmart, Target, Costco, Sam’s Club, BJ’s Wholesale Club
Snack and Nonalcoholic Beverage Bars	0.34	2.58	80,831	Starbucks, Dunkin’, Baskin Robbins, Panera Bread, Tropical Smoothie Café, Auntie Anne’s, Smoothie King, Orange Julius, Cold Stone Creamery, Jamba
Religious Organizations	0.10	0.75	138,390	Life Church
Pharmacies and Drug Stores	0.24	1.45	40,091	CVS Pharmacy, CVS, Walgreens, Walgreens Pharmacy, Walmart Pharmacy, Health Mart, Rite Aid, Rite Aid Pharmacy, Publix Pharmacy, Kroger Pharmacy
Limited-Service Restaurants	0.30	3.89	101,647	Subway, McDonald’s, Hunt Brothers Pizza, Taco Bell, Pizza Hut, Wendy’s, Burger King, Domino’s Pizza, Little Caesars, Dairy Queen
Hotels (except Casino Hotels) and Motels	0.38	0.97	21,948	Best Western, Hampton, Holiday Inn Express, Quality Inn, Super 8, Days Inn, Motel 6, Fairfield Inn & Suites by Marriott, Comfort Inn, Courtyard by Marriott
Convenience Stores	0.15	2.40	43,534	Shell Oil, Chevron, BP, Sunoco, Valero Energy, Exxon Mobil, Circle K Gas, Mobil, Speedway, Marathon
Full-Service Restaurants	0.31	6.30	279,762	Waffle House, IHOP, Denny’s, Applebee’s, Buffalo Wild Wings, Marco’s Pizza, Chili’s Grill & Bar, Moe’s Southwest Grill, Dickey’s Barbecue Pit, Olive Garden
Fitness and Recreational Sports Centers	0.24	2.17	94,074	CrossFit, Anytime Fitness, Planet Fitness, Orangetheory Fitness, Snap Fitness, F45 Training, Club Pilates, Pure Barre, 9Round, LA Fitness
Drinking Places (Alcoholic Beverages)	0.38	0.87	32,390	Dave & Buster’s, Bar Louie, Smokey Bones, The Brass Tap, Wings Etc., Hurricane Grill & Wings, Vino Volo, Marlow’s Tavern, brick house TAVERN + TAP, Fox & Hound

Table S7. Summary of Selected Activity Categories Used to Analyze Visit-based Charging Accessibility

2 Public Charging Infrastructure Accessibility

2.1 Summary Statistics

Metro Area	Count	Mean	Std	Min	25%	50%	75%	Max
Albany, NY	508.0	6.131	4.674	0.000	2.355	5.393	9.216	19.749
Atlanta, GA	3418.0	3.043	7.404	0.000	0.124	0.574	2.027	75.959
Austin, TX	1068.0	4.994	9.180	0.000	0.507	1.894	4.877	81.722
Baltimore, MD	1650.0	4.575	7.507	0.000	1.034	1.895	4.168	54.979
Boston, MA	3357.0	10.233	19.834	0.000	1.012	3.227	8.626	135.427
Chicago, IL	6311.0	1.845	5.154	0.000	0.273	0.729	1.551	65.170
Dallas, TX	3497.0	1.495	3.119	0.000	0.217	0.629	1.487	36.361
Denver, CO	1900.0	4.235	7.649	0.000	1.061	2.029	3.961	65.687
Kansas City, KS	1462.0	4.217	8.033	0.000	0.551	1.821	4.578	79.910
Los Angeles, CA	8134.0	9.902	12.269	0.000	2.639	5.367	12.310	129.278
Miami, FL	3915.0	3.352	5.892	0.000	0.524	1.303	3.261	49.527
New York, NY	5297.0	2.339	3.425	0.000	0.517	1.307	2.748	29.478
Philadelphia, PA	4396.0	2.158	4.309	0.000	0.275	0.738	1.870	33.173
Phoenix, AZ	2620.0	1.788	2.759	0.000	0.313	0.858	2.095	29.812
Sacramento, CA	1255.0	4.002	8.736	0.000	0.598	1.397	3.546	83.599
San Diego, CA	1954.0	5.538	10.433	0.000	1.326	2.674	5.127	103.607
San Francisco, CA	2508.0	14.067	18.837	0.000	2.870	6.412	16.184	123.940
San Jose, CA	1161.0	14.532	14.624	0.000	3.203	9.469	21.369	89.309
Seattle, WA	2456.0	8.112	23.683	0.000	0.701	1.834	4.194	198.497
Washington, DC	3357.0	7.660	14.165	0.000	0.968	2.769	6.734	102.970

Table S8. Distance-based Accessibility Description

Metro Area	Count	Mean	Std	Min	25%	50%	75%	Max
Albany, NY	508.0	0.425	0.084	0.185	0.373	0.419	0.475	0.859
Atlanta, GA	3418.0	0.363	0.116	0.086	0.285	0.346	0.418	0.839
Austin, TX	1068.0	0.332	0.106	0.105	0.256	0.312	0.384	0.822
Baltimore, MD	1650.0	0.457	0.123	0.107	0.370	0.447	0.536	0.93
Boston, MA	3357.0	0.448	0.170	0.042	0.319	0.440	0.576	0.967
Chicago, IL	6310.0	0.364	0.170	0.014	0.245	0.338	0.456	0.975
Dallas, TX	3497.0	0.194	0.072	0.065	0.146	0.179	0.227	0.706
Denver, CO	1899.0	0.311	0.097	0.059	0.244	0.298	0.362	1.000
Kansas City, KS	1462.0	0.277	0.091	0.095	0.212	0.270	0.321	0.883
Los Angeles, CA	8131.0	0.481	0.139	0.063	0.379	0.463	0.575	0.994
Miami, FL	3915.0	0.336	0.144	0.031	0.237	0.300	0.393	0.932
New York, NY	14365.0	0.408	0.202	0.015	0.246	0.377	0.558	1.000
Philadelphia, PA	4396.0	0.265	0.143	0.028	0.163	0.227	0.329	0.847
Phoenix, AZ	2620.0	0.297	0.130	0.069	0.184	0.285	0.382	0.939
Sacramento, CA	1255.0	0.323	0.095	0.110	0.260	0.304	0.371	0.835
San Diego, CA	1954.0	0.387	0.105	0.083	0.314	0.377	0.450	0.809
San Francisco, CA	2508.0	0.521	0.154	0.047	0.419	0.510	0.607	1.000
San Jose, CA	1161.0	0.421	0.148	0.059	0.310	0.394	0.512	0.965
Seattle, WA	2456.0	0.462	0.172	0.067	0.328	0.434	0.568	0.965
Washington, DC	3357.0	0.467	0.163	0.112	0.350	0.450	0.563	1.000

Table S9. Visit-based Accessibility Description

2.2 Gini Index

Metro Area	Distance-based	Visit-based
Albany, NY	0.429	0.109
Atlanta, GA	0.791	0.174
Austin, TX	0.690	0.170
Baltimore, MD	0.637	0.150
Boston, MA	0.718	0.216
Chicago, IL	0.705	0.258
Dallas, TX	0.673	0.189
Denver, CO	0.616	0.167
Kansas City, KS	0.662	0.176
Los Angeles, CA	0.549	0.163
Miami, FL	0.665	0.226
New York, NY	0.591	0.278
Philadelphia, PA	0.704	0.285
Phoenix, AZ	0.623	0.247
Sacramento, CA	0.695	0.155
San Diego, CA	0.619	0.151
San Francisco, CA	0.602	0.165
San Jose, CA	0.522	0.195
Seattle, WA	0.798	0.209
Washington, DC	0.695	0.196

Table S10. Gini Index for Distance-based and Visit-based Accessibility by Metro Area

2.3 OLS Results for Sociodemographic Features

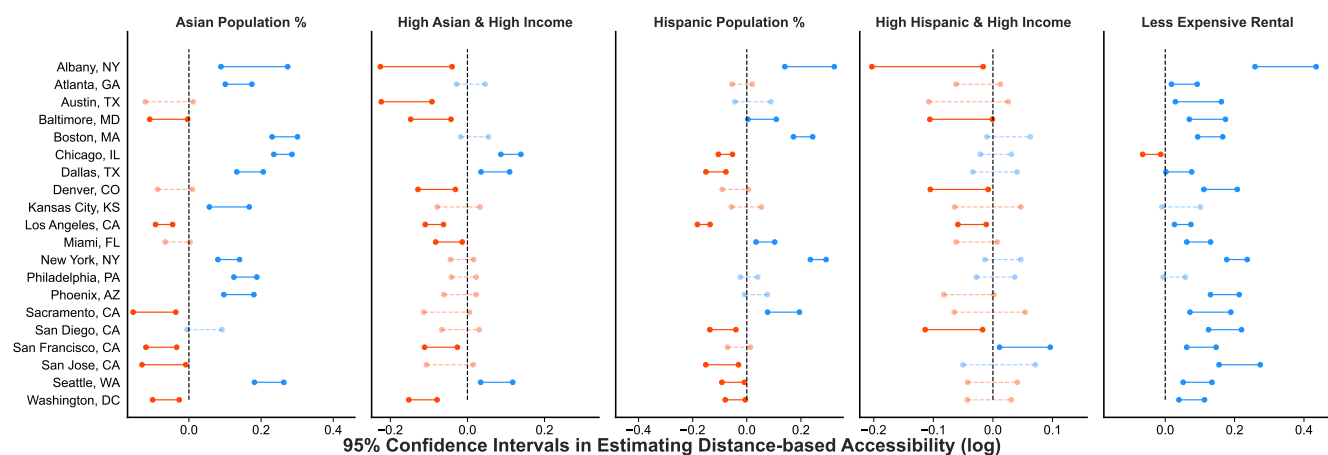


Figure S1. Supplementary OLS results for income and race association with distance-based charging accessibility

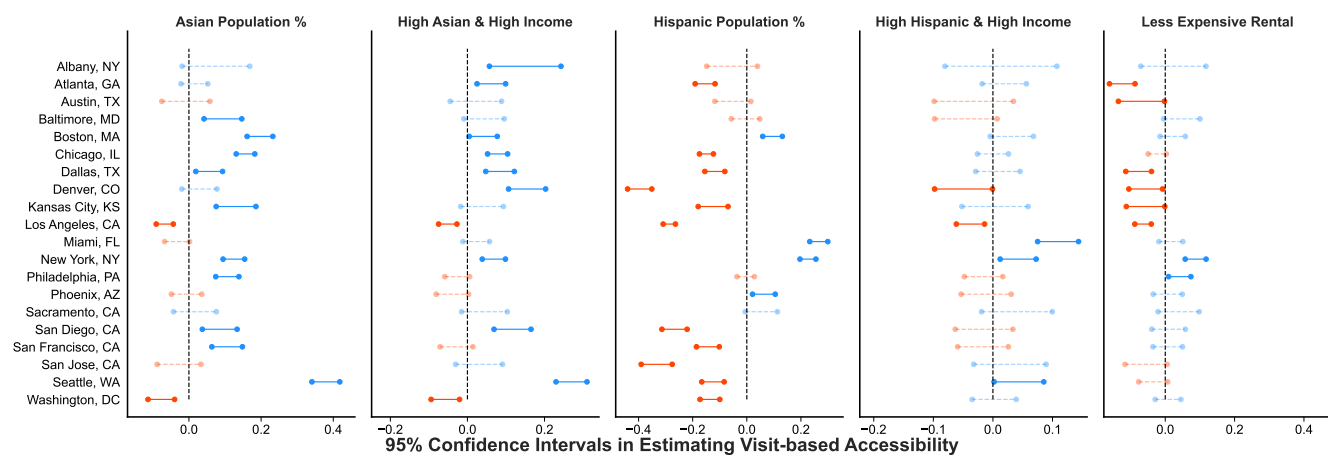


Figure S2. Supplementary OLS results for income and race association with visit-based charging accessibility

3 Experienced Charging Segregation

3.1 Descriptive Statistics (Experienced Income Charging Segregation)

Category	Count	Mean	Std	Min	25%	50%	75%	Max
Drinking Places (Alcoholic Beverages)	52951.0	0.113	0.097	0.000	0.045	0.085	0.151	1.116
Fitness and Recreational Sports Centers	52951.0	0.113	0.089	0.000	0.051	0.089	0.146	0.856
Full-Service Restaurants	52951.0	0.080	0.055	0.003	0.042	0.066	0.104	0.642
Convenience Stores	52951.0	0.181	0.116	0.000	0.095	0.156	0.239	1.428
Hotels (except Casino Hotels) and Motels	52951.0	0.135	0.102	0.000	0.064	0.108	0.177	1.131
Limited-Service Restaurants	52951.0	0.107	0.070	0.000	0.056	0.090	0.140	0.790
Pharmacies and Drug Stores	52951.0	0.090	0.065	0.000	0.043	0.075	0.121	0.838
Religious Organizations	52951.0	0.034	0.058	0.000	0.000	0.015	0.042	0.846
Snack and Nonalcoholic Beverage Bars	52951.0	0.115	0.080	0.000	0.058	0.095	0.151	0.972
Warehouse Clubs and Supercenters	52951.0	0.114	0.086	0.000	0.053	0.093	0.152	1.086

Table S11. Descriptive Statistics of Experienced Charging Segregation (Income) by Category

Metro Area	Convenience Stores	Religious Organizations	Full-Service Restaurants	Snack and Nonalcoholic Beverage Bars	Drinking Places (Alcoholic Beverages)	Hotels (except Casino Hotels) and Motels	Limited-Service Restaurants	Fitness and Recreational Sports Centers	Pharmacies and Drug Stores	Warehouse Clubs and Supercenters
Albany, NY	0.132	0.087	0.088	0.117	0.169	0.103	0.083	0.116	0.075	0.092
Atlanta, GA	0.138	0.038	0.063	0.094	0.094	0.123	0.097	0.104	0.065	0.106
Austin, TX	0.173	0.018	0.062	0.069	0.061	0.085	0.096	0.062	0.101	0.115
Baltimore, MD	0.113	0.006	0.059	0.071	0.109	0.102	0.091	0.113	0.071	0.078
Boston, MA	0.153	0.000	0.075	0.120	0.078	0.080	0.089	0.041	0.089	0.113
Chicago, IL	0.208	0.032	0.088	0.100	0.096	0.124	0.097	0.117	0.080	0.114
Dallas, TX	0.152	0.020	0.084	0.145	0.103	0.105	0.133	0.095	0.100	0.142
Denver, CO	0.122	0.035	0.065	0.107	0.100	0.102	0.089	0.088	0.052	0.067
Kansas City, KS	0.159	0.007	0.080	0.148	0.132	0.158	0.122	0.110	0.071	0.081
Los Angeles, CA	0.142	0.000	0.057	0.080	0.070	0.129	0.071	0.073	0.068	0.059
Miami, FL	0.149	0.019	0.043	0.083	0.046	0.058	0.110	0.079	0.070	0.110
New York, NY	0.202	0.000	0.118	0.149	0.106	0.171	0.138	0.128	0.138	0.121
Philadelphia, PA	0.243	0.003	0.086	0.138	0.167	0.146	0.111	0.116	0.116	0.135
Phoenix, AZ	0.197	0.060	0.068	0.071	0.093	0.142	0.074	0.099	0.086	0.074
Sacramento, CA	0.155	0.004	0.069	0.113	0.044	0.096	0.122	0.109	0.067	0.094
San Diego, CA	0.156	0.011	0.069	0.107	0.104	0.113	0.087	0.093	0.061	0.064
San Francisco, CA	0.161	0.006	0.056	0.065	0.067	0.092	0.063	0.074	0.051	0.038
San Jose, CA	0.178	0.004	0.079	0.109	0.104	0.139	0.087	0.081	0.086	0.113
Seattle, WA	0.124	0.022	0.057	0.077	0.066	0.092	0.072	0.103	0.058	0.165
Washington, DC	0.143	0.018	0.050	0.085	0.071	0.079	0.071	0.070	0.062	0.065

Table S12. Metros' Median Experienced Charging Segregation (Income) by Category

3.2 Descriptive Statistics (Experienced Racial Charging Segregation)

Category	Count	Mean	Std	Min	25%	50%	75%	Max
Drinking Places (Alcoholic Beverages)	52951.0	0.083	0.077	0.000	0.033	0.062	0.106	0.950
Fitness and Recreational Sports Centers	52951.0	0.086	0.070	0.001	0.039	0.068	0.112	1.105
Full-Service Restaurants	52951.0	0.079	0.073	0.001	0.031	0.057	0.099	0.832
Convenience Stores	52951.0	0.093	0.080	0.000	0.040	0.070	0.119	1.128
Hotels (except Casino Hotels) and Motels	52951.0	0.082	0.073	0.000	0.035	0.063	0.105	1.151
Limited-Service Restaurants	52951.0	0.076	0.072	0.000	0.030	0.054	0.094	0.850
Pharmacies and Drug Stores	52951.0	0.088	0.083	0.000	0.035	0.063	0.112	1.005
Religious Organizations	52951.0	0.132	0.108	0.000	0.058	0.101	0.170	1.265
Snack and Nonalcoholic Beverage Bars	52951.0	0.073	0.066	0.000	0.029	0.053	0.094	0.753
Warehouse Clubs and Supercenters	52951.0	0.109	0.093	0.000	0.045	0.082	0.144	0.931

Table S13. Descriptive Statistics of Experienced Charging Segregation (Racial) by Category

Metro Area	Convenience Stores	Religious Organizations	Full-Service Restaurants	Snack and Nonalcoholic Beverage Bars	Drinking Places (Alcoholic Beverages)	Hotels (except Casino Hotels) and Motels	Limited-Service Restaurants	Fitness and Recreational Sports Centers	Pharmacies and Drug Stores	Warehouse Clubs and Supercenters
Albany, NY	0.037	0.060	0.027	0.028	0.041	0.056	0.022	0.031	0.031	0.074
Atlanta, GA	0.074	0.119	0.064	0.054	0.074	0.077	0.065	0.088	0.065	0.089
Austin, TX	0.032	0.056	0.037	0.030	0.032	0.028	0.036	0.048	0.041	0.054
Baltimore, MD	0.069	0.101	0.045	0.042	0.051	0.062	0.051	0.081	0.057	0.073
Boston, MA	0.064	0.073	0.047	0.053	0.052	0.043	0.052	0.060	0.058	0.084
Chicago, IL	0.115	0.134	0.086	0.087	0.096	0.079	0.088	0.098	0.110	0.128
Dallas, TX	0.069	0.095	0.056	0.067	0.068	0.064	0.061	0.077	0.088	0.120
Denver, CO	0.048	0.076	0.053	0.049	0.044	0.042	0.050	0.048	0.043	0.058
Kansas City, KS	0.043	0.074	0.027	0.029	0.039	0.045	0.034	0.040	0.035	0.048
Los Angeles, CA	0.071	0.096	0.059	0.055	0.068	0.081	0.048	0.066	0.061	0.075
Miami, FL	0.070	0.102	0.067	0.056	0.059	0.053	0.065	0.070	0.079	0.103
New York, NY	0.105	0.162	0.093	0.090	0.127	0.111	0.085	0.103	0.104	0.118
Philadelphia, PA	0.100	0.145	0.090	0.084	0.091	0.071	0.082	0.102	0.089	0.136
Phoenix, AZ	0.054	0.087	0.039	0.037	0.046	0.056	0.038	0.051	0.055	0.055
Sacramento, CA	0.047	0.099	0.044	0.055	0.027	0.047	0.042	0.045	0.054	0.060
San Diego, CA	0.072	0.094	0.054	0.053	0.059	0.066	0.050	0.055	0.054	0.057
San Francisco, CA	0.081	0.088	0.038	0.036	0.047	0.067	0.038	0.067	0.043	0.033
San Jose, CA	0.065	0.100	0.047	0.047	0.059	0.075	0.042	0.065	0.064	0.098
Seattle, WA	0.038	0.074	0.039	0.037	0.039	0.046	0.036	0.050	0.031	0.057
Washington, DC	0.072	0.113	0.053	0.039	0.047	0.058	0.051	0.063	0.056	0.074

Table S14. Metros' Median Experienced Charging Segregation (Racial) by Category

3.3 Quantile Regression Results

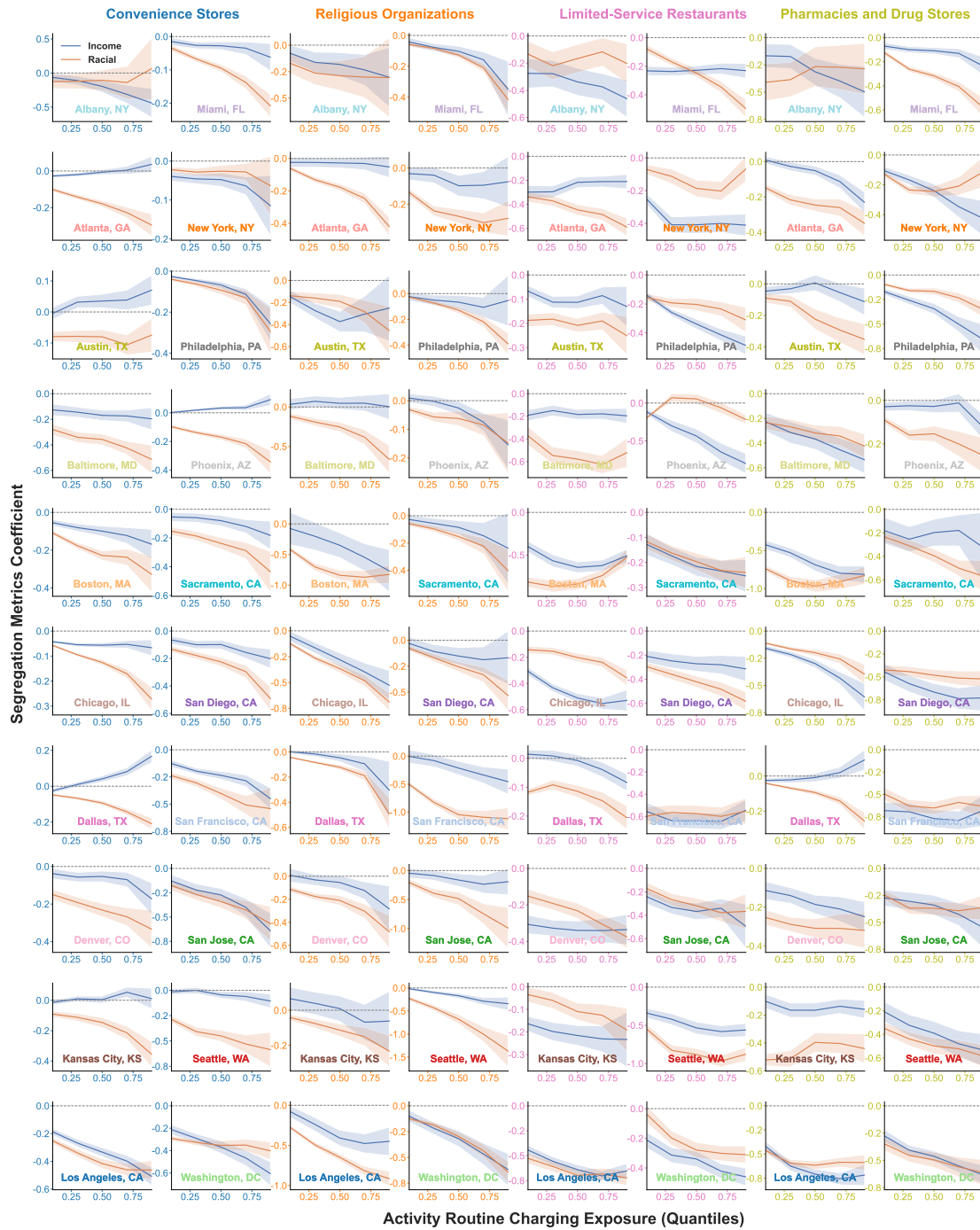


Figure S3. Quantile regression results for the association of experienced racial and income segregation with charging exposure.

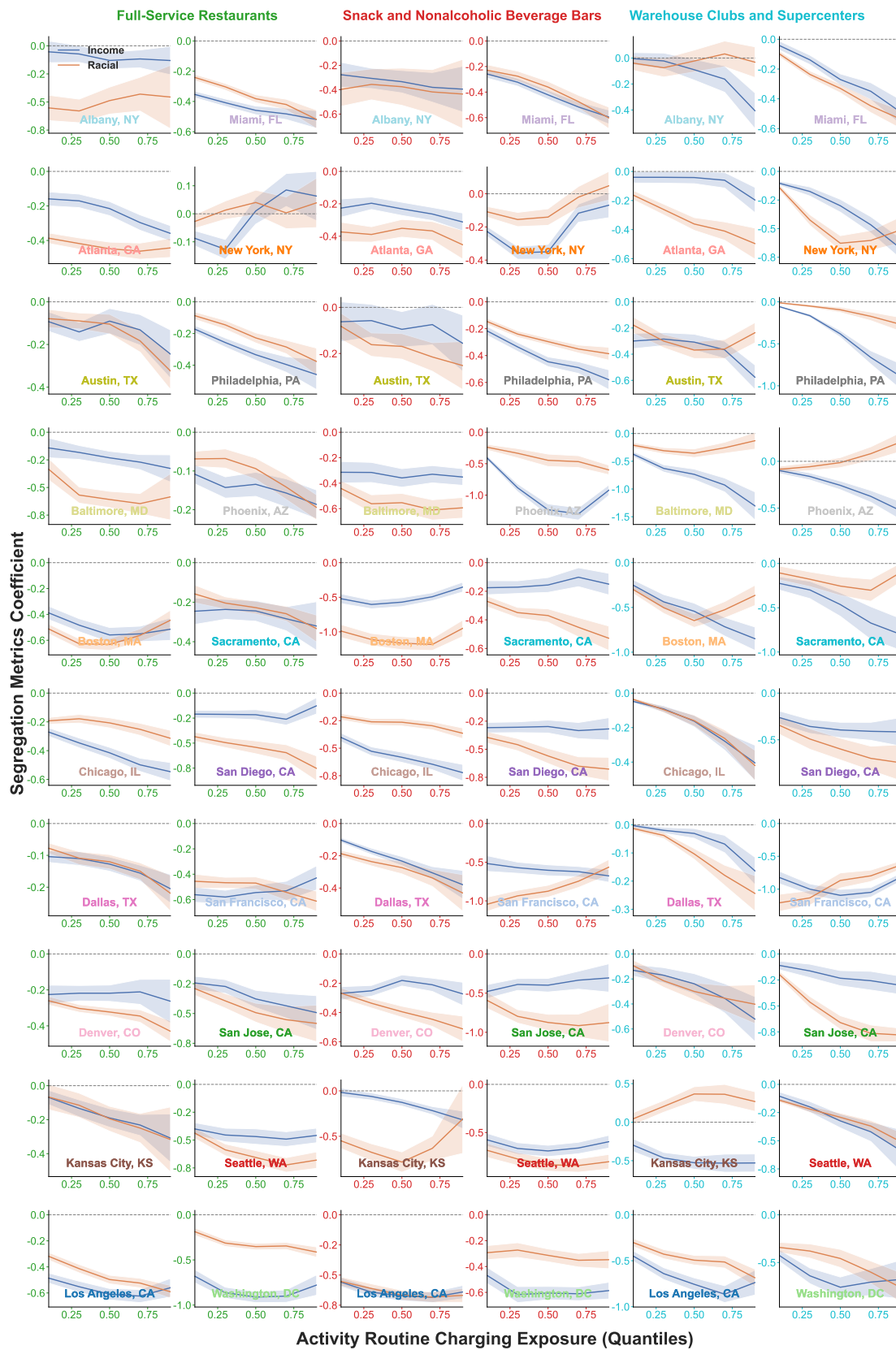


Figure S4. Quantile regression results for the association of experienced racial and income segregation with charging exposure.

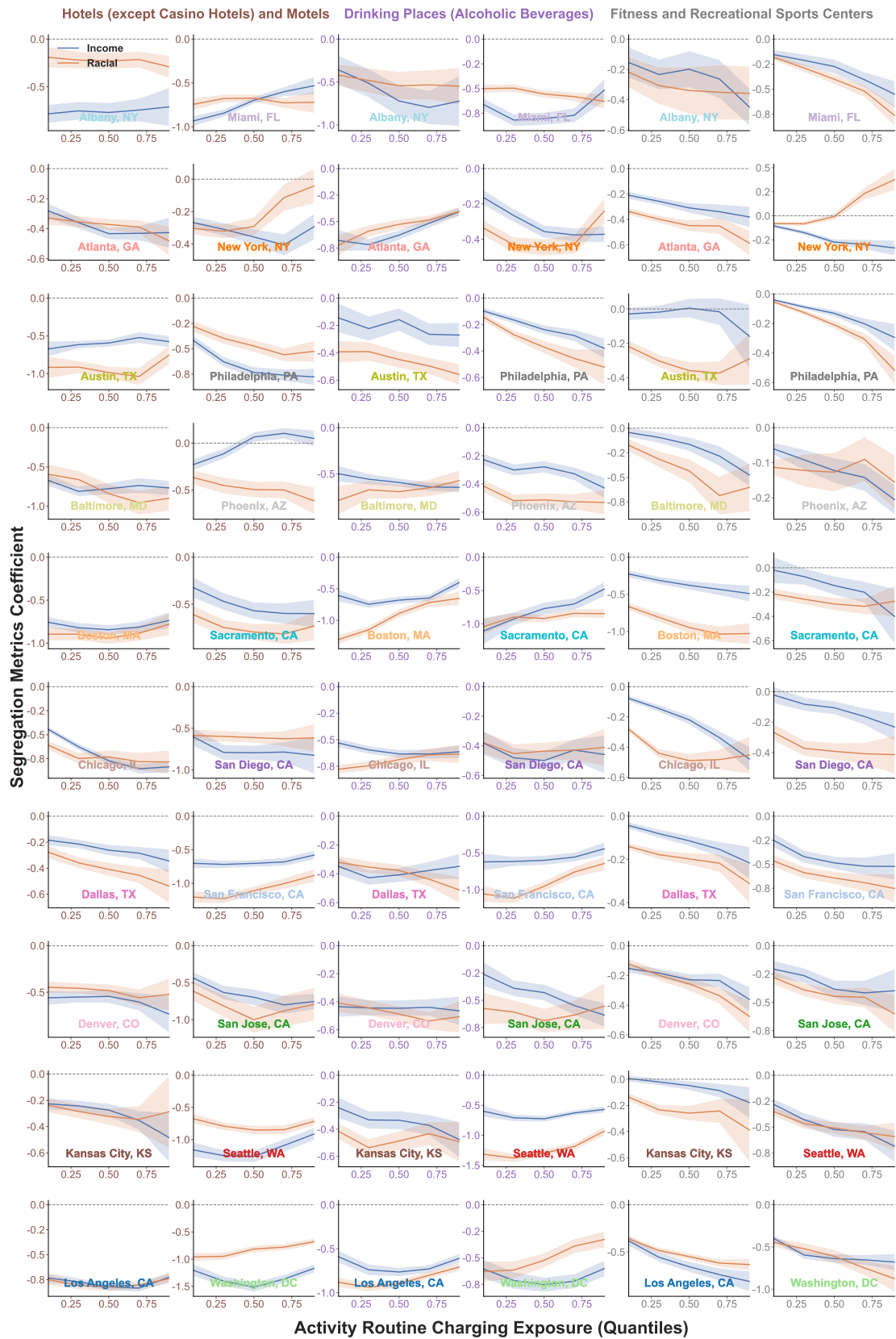


Figure S5. Quantile regression results for the association of experienced racial and income segregation with charging exposure.

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