
The 15-minute city quantified using human mobility data

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Supplementary Table 1: NAICS codes by category of essential functions

Category	6-Digit NAICS Code
Healthcare	621111, 621112, 621410, 621492, 621493, 621498, 622110 ..
Drugstores	446110.....
Schools	611110.....
Religious Organizations	813110.....
Restaurants	722511, 722513, 722514, 722515
Groceries	445110, 445120.....
Parks	712190.....
Cultural Institutions	711190, 711310, 712110
Services	491110, 522110, 812111, 812112, 812113, 812320.....

Notes.— The table lists 6-digit NAICS codes associated with the different categories of essential functions in the paper.

Supplementary Table 2: Correlation of various measures of local living with 15 min. usage

Alternate measure	Neighborhood level correlation	Neighborhood level mean	Urban area level correlation	Urban area level mean
	(1)	(2)	(3)	(4)
15 min. usage	1.000	0.239	1.000	0.158
10 min. usage	0.839	0.175	0.927	0.108
20 min. usage	0.903	0.284	0.960	0.190
25 min. usage	0.867	0.337	0.945	0.235
Med. trip dist. (km)	-0.728	2.718	-0.599	3.552
Observations	150,159	150,159	420	420

Notes.— The table shows neighborhood-level correlations and means for different measures of local usage. Column 1 provides the correlation between our baseline usage measure and alternative measures defined by the share of trips within 10, 20, and 25 minutes, as well as the median trip length. Column 2 reports (unweighted) means for these alternative variables. Columns 3 and 4 aggregate the data to urban areas and report urban area-level correlations and (unweighted) means.

Supplementary Table 3: Correlation between different local access measures

	Counts of Amenities within a 15-minute walk (CBG-level)										
	Equal- Weighted Access	All categories	Healthcare	Parks	Restau- rants	Schools	Services	Groceries	Drugstore	Religious	Arts and Culture
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Correlation with baseline access index	0.982	0.984	0.785	0.681	0.969	0.785	0.914	0.858	0.731	0.775	0.379

Notes.— The table shows neighborhood-level Spearman correlations between different measures of local access to services and amenities. Column 1 provides the correlation between our baseline access index and an alternative measure of access, where the scores associated with the number of amenities in each category are added with equal weights. Columns 2–11 provide correlations between our baseline measure and counts of the number of each type of amenity within 15-minute walksheds.

Supplementary Table 4: Relationship between 15-minute usage and access across neighborhoods (Census Block Groups) and Urban areas: Using all POI destinations

	<i>Dependent Variable: 15-minute Usage (% of trips)</i>					
	Across CBGs			Across Urban Areas		
	(1)	(2)	(3)	(4)	(5)	(6)
15-minute Access	0.621*** p < 0.001	0.546*** p < 0.001	0.553*** p < 0.001	0.414*** p < 0.001	0.303*** p < 0.001	0.311*** p < 0.001
Pop Density Log		0.825*** p = 0.009	0.365 p = 0.138		2.781*** p < 0.001	2.427*** p < 0.001
Median Income Log		-5.966*** p < 0.001	-5.512*** p < 0.001		-4.480*** p < 0.001	-5.256*** p < 0.001
% Education: BA +		0.038*** p < 0.001	0.025*** p = 0.001		0.062*** p < 0.001	0.036*** p = 0.008
% White		-0.017*** p = 0.002	-0.021*** p < 0.001		0.012 p = 0.254	0.005 p = 0.617
Transit Frequency (per sq. mi)			0.001*** p = 0.003			0.005*** p < 0.001
Average Commute (mi)			0.118*** p < 0.001			-0.098*** p < 0.001
Urban Area FE	✓	✓	✓			
Observations	150,159	145,862	145,859	420	420	420
R ²	0.715	0.741	0.748	0.699	0.731	0.786
Partial R ²	0.712	0.626	0.634	0.699	0.512	0.525

Notes.— The table reports OLS estimates of the relationship between 15-minute usage and access. It uses the specifications from Table 1, but redefines the outcome variable to include trips to all POI destinations (as opposed to only consumption trips). Columns 1 to 3 report estimates at the neighborhood level (controlling for urban area fixed effects) and columns 4 to 6 report estimates at the urban area level. The partial R-squared for access is computed as $\beta \times \frac{\text{cov}(15\text{-minute usage}, 15\text{-minute access})}{\text{var}(15\text{-minute usage})}$, where β is the regression coefficient for 15-minute access. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors clustered at the county level.

Supplementary Table 5: Relationship between 15-minute usage and access across neighborhoods (Census Block Groups) and Urban areas: Role of transit access

	<i>Dependent Variable: 15-minute Usage (% of trips)</i>			
	Across CBGs		Across Urban Areas	
	(1)	(2)	(3)	(4)
15-minute Access	0.715*** p < 0.001	0.742*** p < 0.001	0.493*** p < 0.001	0.460*** p < 0.001
Pop Density Log	0.183 p = 0.378	2.419*** p < 0.001	2.124*** p < 0.001	3.090** p = 0.017
Median Income Log	-4.238*** p < 0.001	-5.882*** p < 0.001	-3.328*** p < 0.001	-3.298** p = 0.017
% Education: BA +	-0.0003 p = 0.948	-0.002 p = 0.867	0.018 p = 0.132	0.054** p = 0.014
% White	-0.006 p = 0.238	0.009 p = 0.376	-0.005 p = 0.587	0.025 p = 0.180
Transit Frequency (per sq. mi)	0.001*** p = 0.005	0.0003** p = 0.022	0.003*** p = 0.003	0.003** p = 0.049
Average Commute (mi)	0.107*** p < 0.001	0.104*** p < 0.001	-0.094*** p < 0.001	-0.066*** p = 0.005
Full sample	✓		✓	
Only transit freq. above median		✓		✓
Urban Area FE	✓	✓		
Observations	145,859	44,492	420	129
R ²	0.756	0.625	0.875	0.819

Notes.— The table reports OLS estimates of the relationship between 15-minute usage and access for areas with high transit access. Columns 1 and 3 report estimates from specifications identical to columns 3 and 6 in Table 1, respectively. Columns 2 and 4 restricts the estimation sample to CBGs and Urban Areas with above-average transit frequency per square mile (obtained from EPA). The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors clustered at the county level.

Supplementary Table 6: OLS and IV estimates for New York City: subsample of low-mobility neighborhoods (proxied by a high share of children that live and grew up in the same tract)

	<i>Dependent variable:</i>			
	Usage (% of trips within a 15m walk)			
	OLS	IV estimates		
	(1)	(2)	(3)	(4)
Access to amenities within a 15m walk	0.835*** p < 0.001	1.131*** p < 0.001	1.088*** p < 0.001	1.207*** p < 0.001
Population Density (Log)	3.776*** p < 0.001		3.371*** p < 0.001	3.325*** p < 0.001
Median Income (Log)	-4.490*** p < 0.001		-4.310*** p < 0.001	-4.378*** p < 0.001
IV: Log Average Commercial FAR in 1961 Resolution		✓	✓	✓
Distance to City Center	✓	✓	✓	✓
1960 Population and Housing Density	✓	✓	✓	✓
1960 Workers by Industry	✓	✓	✓	✓
1960 Poor and Non-white Families				✓
First stage F-stat	NA	71.14	67.12	53.01
Observations	1,326	1,385	1,326	1,326
R ²	0.563	0.497	0.556	0.552

Notes.— This table reports OLS and IV estimates of the relationship between 15-minute usage and access for New York City. We use the specifications from Table 2 and restrict the estimation sample to low-mobility neighborhoods, defined as those in the top quartile according to the share of children who grew up and still live in the same Census tract by 2015. These data come from the Opportunity Atlas (Chetty et al. 2018). Column 1 reports OLS estimates controlling for distance to the city center and a host of socio-economic controls for 1960, including population and housing density and the share of workers by industry. Columns 2-4 report IV estimates. Columns 2 and 3 control for distance to the city center, population and housing density and the share of workers by industry. Column 4 includes additional controls for the share of poor and non-white families in 1960. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors.

Supplementary Table 7: Relationship between experienced segregation and local trips for neighborhoods of different income levels.

	<i>Dependent variable:</i>			
	Physical Segregation Index (PSI)			
	Main 15 urban areas		Full sample	
	(1)	(2)	(3)	(4)
Usage $\times$ Low income	0.164***		0.071***	
	p < 0.001		p < 0.001	
Usage $\times$ Moderate-low income	0.041**		0.007	
	p = 0.013		p = 0.318	
Usage $\times$ Moderate-high income	-0.069***		-0.056***	
	p < 0.001		p < 0.001	
Usage $\times$ High income	-0.103***		-0.060***	
	p < 0.001		p < 0.001	
Access $\times$ Low income		0.182***		0.041***
		p < 0.001		p = 0.003
Access $\times$ Moderate-low income		0.043***		-0.009
		p = 0.006		p = 0.131
Access $\times$ Moderate-high income		-0.084***		-0.069***
		p < 0.001		p < 0.001
Access $\times$ High income		-0.114***		-0.070***
		p < 0.001		p < 0.001
Urban area fixed effects	✓	✓	✓	✓
R-squared	0.17	0.20	0.24	0.24
Observations	34739	34739	145855	145855

Notes.— The table reports OLS estimates of the relationship between experienced segregation and 15-minute usage (columns 1 and 3) and access (columns 2 and 4). We provide estimates for neighborhoods in the 15 cities with the highest levels of 15-minute usage and for all neighborhoods in our sample. The table reports estimates interacted with dummies for low income neighborhoods (bottom quartile of income in urban area), moderate-low income neighborhoods (second quartile), moderate-high income neighborhoods (third quartile), and high income neighborhoods (top quartile). Robust standard errors are computed with clustering at the urban area level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors.

Supplementary Table 8: Relationship between business counts in Safegraph and Census Data

	All County x Industry Pairs	
	Establishments Count from Census (CBP)	
	(1)	(2)
Establishments Count from Safegraph	0.925*** p < 0.001	0.991*** p < 0.001
Two-Digit NAICS Code FE	No	Yes
Observations	11,391	11,391
R ²	0.521	0.591

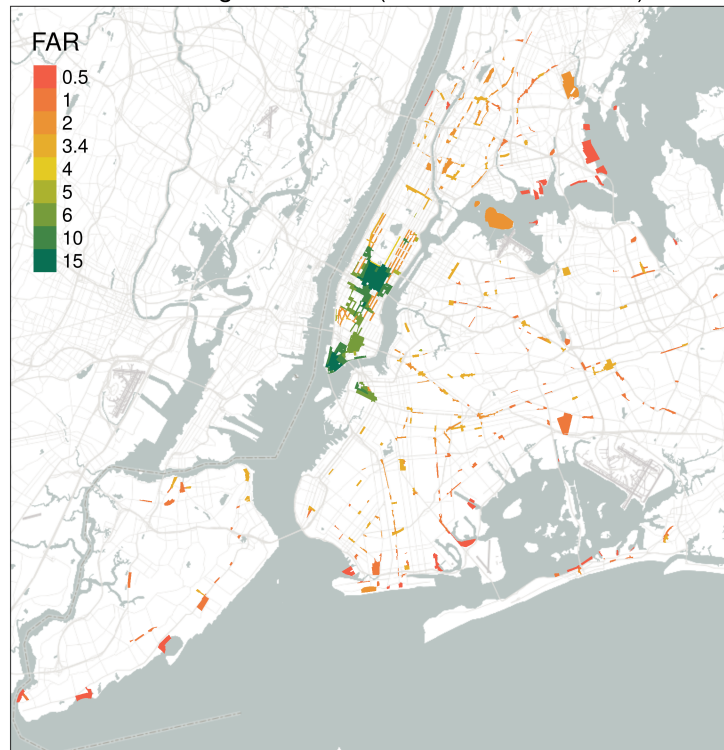
Notes.— This table reports estimates from a regression of the number of businesses in a county (from the 2019 Census County Business Patterns data, CBP) and the number of Safegraph establishments in the same two-digit NAICS category and county. Each observation corresponds to a county and two-digit industry cell. Column (1) reports estimates from a pooled OLS regression of Census establishment counts on Safegraph establishment counts across these cells, and column (2) presents the results of estimating the same model with two-digit NAICS code fixed effects added. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors clustered at the county level.

Supplementary Table 9: First-stage and reduced-form estimates of 1961 zoning regulation on current access and usage.

	<i>Dependent variable:</i>			
	Access		Usage (% trips)	
	(1)	(2)	(3)	(4)
Log Average Commercial FAR	6.522*** p < 0.001	4.460*** p < 0.001	7.187*** p < 0.001	5.569*** p < 0.001
Controls:				
Distance to City Center		✓		✓
1960 Population and Housing Density		✓		✓
1960 Workers by Industry		✓		✓
Observations	5,582	5,582	5,582	5,582
R ²	0.475	0.696	0.224	0.329

Notes.— The table reports first-stage (columns 1 and 2) and reduced-form (columns 3 and 4) estimates of the relationship between 1961 zoning and access and usage for neighborhoods in New York City. Columns 2 and 4 control for distance to the city center and a host of socio-economic controls for 1960, including population and housing density and the share of workers by industry. The covariates included in these models come from Twinam (2017) and Martynov (2022). The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level. Included P-values correspond to a two-sided t-test for each estimate, using robust standard errors.

1961 NYC Zoning Resolution (Commercial Districts)



Supplementary Figure 1: HISTORICAL ZONING. Maximum floor-to-area ratio in commercial uses established according to the 1961 New York City Zoning Resolution.