The Value of Street-level Greenness

The Financial Impact of Street-level Greenness on New York Commercial Real Estate

MIT SA+P MIT SCHOOL OF ARCHITECTURE AND PLANNING

CENTER FOR REAL ESTATE

MIT Real Estate Innovation Lab

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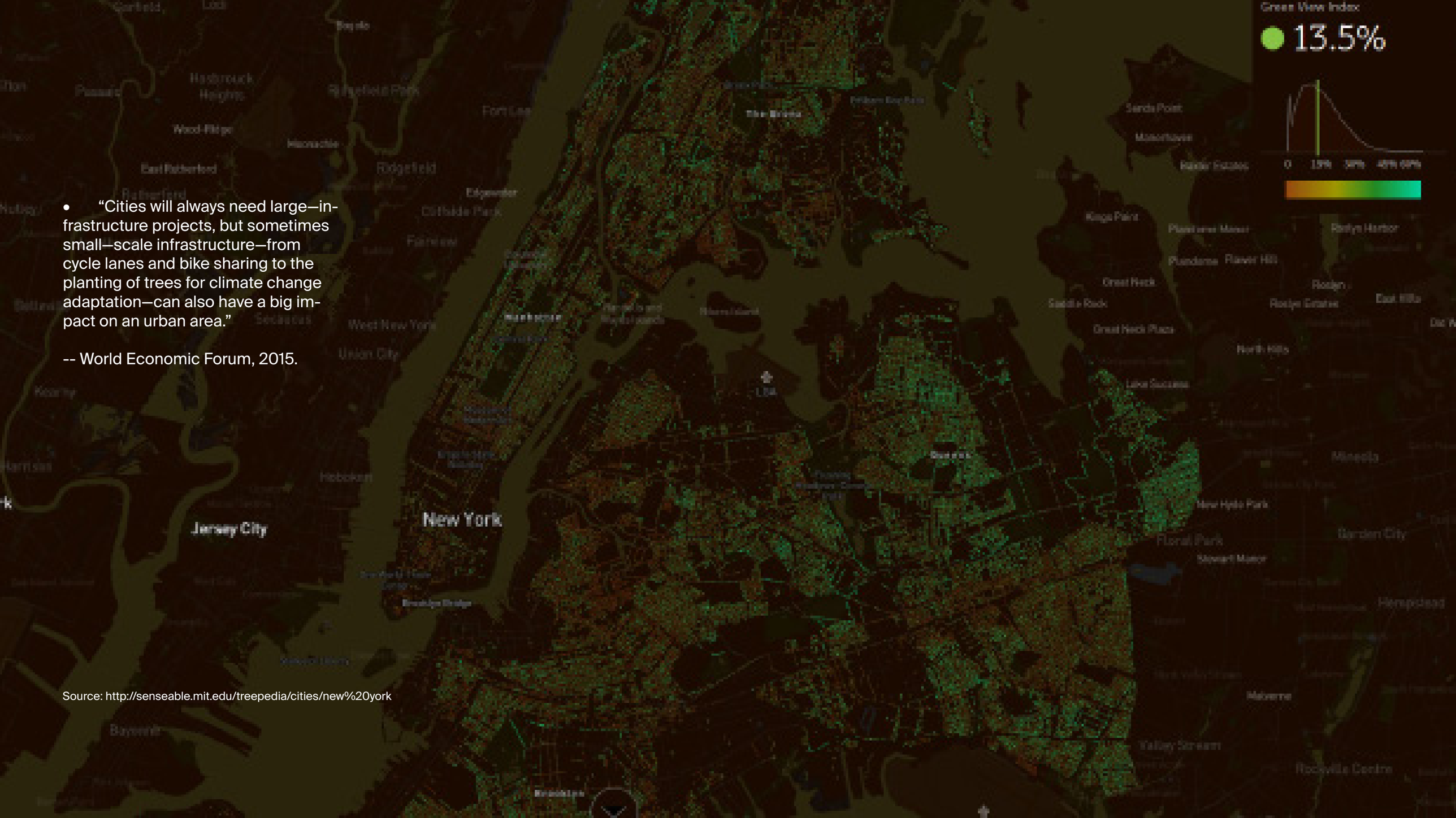
Postdoctoral Researcher at MIT Senseable City Laboratory.



- “Cities will always need large—infrastructure projects, but sometimes small—scale infrastructure—from cycle lanes and bike sharing to the planting of trees for climate change adaptation—can also have a big impact on an urban area.”

-- World Economic Forum, 2015.

Source: http://senseable.mit.edu/treepedia/cities/new%20york

How does street level greenery impact us and why would we consider it relevant for our urban future?

- Increased greenery is correlated with a decreased urban carbon footprint (Chen, 2015) and increased oxygen generation (Nowak et al., 2007);
- More urban greenery boosts the residents thermal comfort in a city (Norton et al, 2015) and the provision of more greenery has been tied to increased equity between neighborhoods and satisfaction (Ambrey and Fleming, 2014);
- Greenery is most closely aligned with public health and wellness, which is leading to enhanced cognition, increased perceived mental health and decreased all cause-mortality (Bratman et al., 2015; Perini and Magliocco, 2014; Van Dillen et al, 2012; Van den Berg et al., 2015; Kang et al., 2020);
- Access to parks has been correlated with higher residential property values (Nicholls and Crompton, 2005) and results already documented that street-level greenery had a positive value impact (Morancho, 2003).
- Its also a prime indicator for social inequality, urban variation in access to trees is also a signal of inequality in social outcomes and racisim (See NYTimes).

How much does street-level greenness affect commercial real estate prices?

- This research measures street-level greenness in Manhattan, New York City through computing a novel street-level green view index using machine learning image recognition techniques from images collected from Google Street View and assess its impacts on real estate pricing.
- The results show that street-level greenery is statistically and economically significant for commercial property prices. Dense greenery, yields a positive coefficient for commercial real estate transaction prices, ranging from 4.7% - 6.3% more per square meter depending on the size of the areas from which we collected Google Street View images.
- These results are robust to various specifications and robustness checks including: investment by Building Improvement Districts, proximity to parks and metros, various specifications of the Green Index as well as alternative measures to identify so-called "greenness".

How has urban greenery been evaluated in the past?

Existing Literature on Greenery

There is limited literature that focuses on the financial valuation of street-level greenness.

LITERATURE

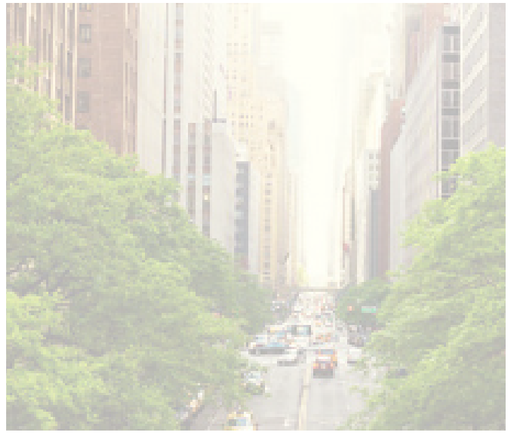
- Real estate economists and planning researchers generally measure: green land use - park and greenway rather than human-scale street-level greenness data. Only in the recent years scholars started to use Street View images to measure urban greenery.

Parks

- Urban parks may yield a positive impact of up to 20 percent to adjacent properties compared to the average price in the same area (Crompton, 2001);
- Morancho (2013) concludes that every 100m further away from a green area equates to a drop of 300,000 pesetas (approximately USD 2,000) in the average home's price;
- Good quality urban greenery improves the quality of life in cities enhancing their attractiveness to residents, employees, tourists, investors and firms (Arvanitidis, 2009).

Green Trails

- Lindsey (2003) documented pricing premiums due to urban greenways ranging from 2.4 percent to 14 percent using 2,157 samples in Indianapolis, Indiana.
- Crompton (2005), documented urban greenway's positive impacts ranging from 5.3 percent to 20.2 percent on property values in multiple residential areas in Austin, Texas;
- The dominant prevailing sentiment was that the presence of a trail had a neutral impact on the saleability or value of property (Crompton, 2003).



Street Greenery

- Yang et al. (2009) were the first to develop the Green View Index (GVI), which used color images captured from four directions as representative of human perception from the street-level to measure the visibility of surrounding urban greenery.
- Lu (2019) assessed street-level greenery using GSV images in Hong Kong and found that the quantity and quality of street-level greenery were positively associated with the likelihood of engaging regular physical activity.

How has urban greenery been evaluated in the past?

Existing Literature on Greenery

There is limited literature that focuses on the financial valuation of street-level greenness.

LITERATURE

- Most studies of street-level urban greenery focused on methodology without providing a comprehensive, theoretical understanding of the street-level urban greenery metric.
- Existing real estate research that studied human-scale greenery focused on residential property transactions but not commercial real estate.

Park

- Passive recreation tend to have a positive impact on nearby property values and parks mainly for active recreation are more likely to introduce disturbance and therefore a negative impact on adjacent property values (Lin, 2016);
- Proximity matters a lot, more than park size (Morancho, 2013);
- Usually might contain more diverse activities (Arvanitidis, 2009).

Green Trails

- Trails could be controversial. If it is perceived that the trail may facilitate the movement of economically disadvantaged residents through a relatively affluent neighborhood, then the trail may be supported by the former, but resisted by some people in the latter group, who fear a decrease in their property value (Crompton, 2003);
- The dominant prevailing sentiment was that the presence of a trail had a neutral impact on the saleability or value of property (Crompton, 2003).

Street Greenery

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NOTE

- Street-level greenness is a major source for people's perception of urban greenness, and it is widely accepted as a source of ecological, social, and cultural benefits. However, due to the difficulty of measuring human perception of street-level greenness, few research has attempted to assess the economic value of street-level greenness.
- Existing real estate research that studied human-scale greenery focused on residential property transactions but not commercial real estate.

LITERATURE

- Zhang and Dong, 2018 - Impacts of Street-Visible Greenery on Housing Prices Evidence from a Hedonic Price Model and a Massive Street View Dataset.
- Ye et al, 2019 - Daily Accessed Street Greenery and Housing Price Measuring Economic Performance of Human-Scale Streetscapes via New Urban Data.
- Fu et al, 2019 - Do street-level scene perceptions affect housing prices in Chinese megacities? An analysis using open access datasets and deep learning

More nascent research has been conducted on the relationship between street-level greenness and housing prices using GVI calculated through street-view images. The results show that visible street greenery and street accessibility at global scale hold significant positive coefficients for housing prices, meaning there is a positive economic impact of street level greeness (Zhang et al, 2018; Ye et al, 2019; Fu et al, 2019).

Can we measure how "green" the street experience is?

Identification Strategy

At each assigned coordinate, we calculated the average percentage of green pixels from collected Google Street View images that were taken from April to October in New York City.

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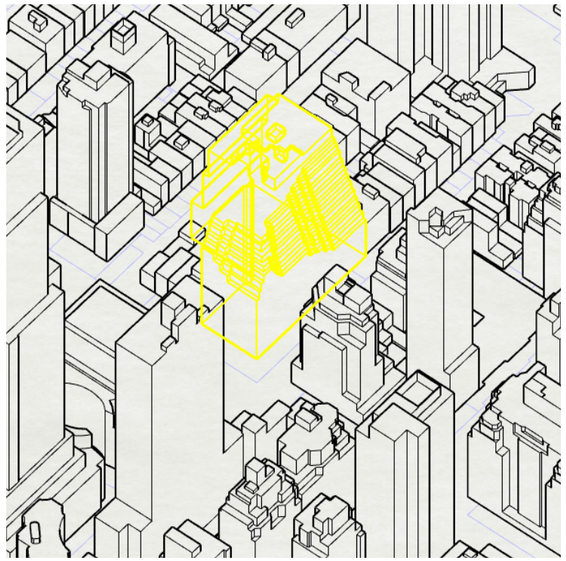
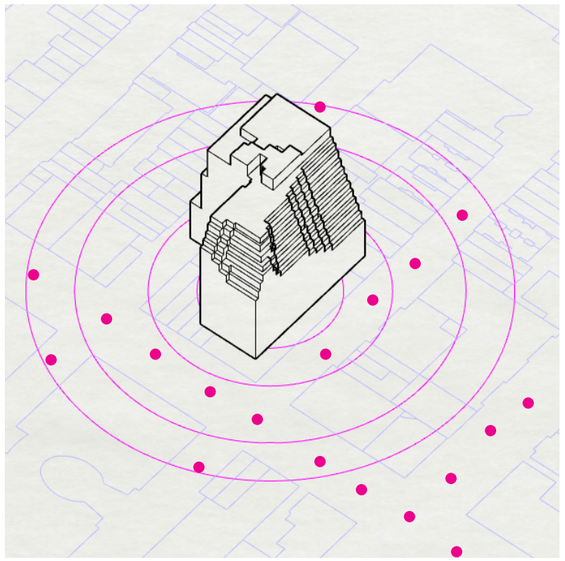
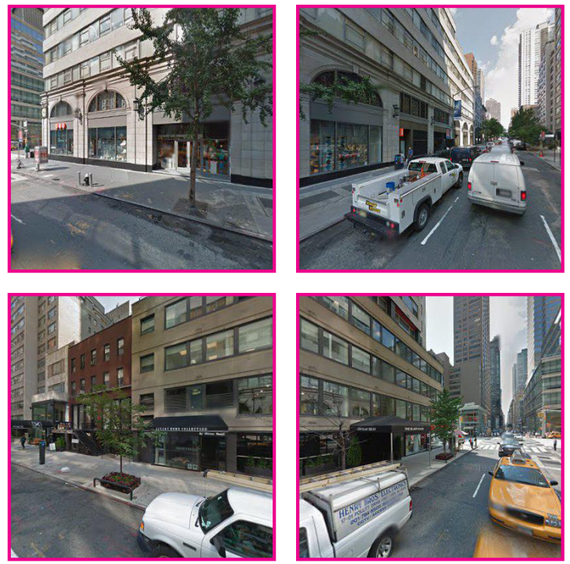
1038623



Address
979 3rd Ave



Collect Google Street View images within 30m, 50m, 80m, and 100m from the target building coordinates.



For each Google Street View panorama, there are four images, on each of which we will calculate the green view index.

Can we measure how "green" the street experience is?

Measuring the "Greenness" of Streetscape

At each assigned coordinate, we calculated the average percentage of green pixels from collected Google Street View images that were taken from April to October in New York City.

WA2_F1AX_BinOfInputAddress
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Green View Index
0.0163875

Name
3FON0VJ2Vw_nshwPYDwjsg_0.jpg

Green View Index
0.0237125

Name
3FON0VJ2Vw_nshwPYDwjsg_90.jpg

Green View Index
0.0242125

Name
3FON0VJ2Vw_nshwPYDwjsg_180.jpg

Green View Index
0.02455625

Name
3FON0VJ2Vw_nshwPYDwjsg_270.jpg

Can we measure how "green" the street experience is?

What is the Green View Index?

At each assigned coordinate, we calculated the average percentage of green pixels from collected Google Street View images that were taken from April to October in New York City.

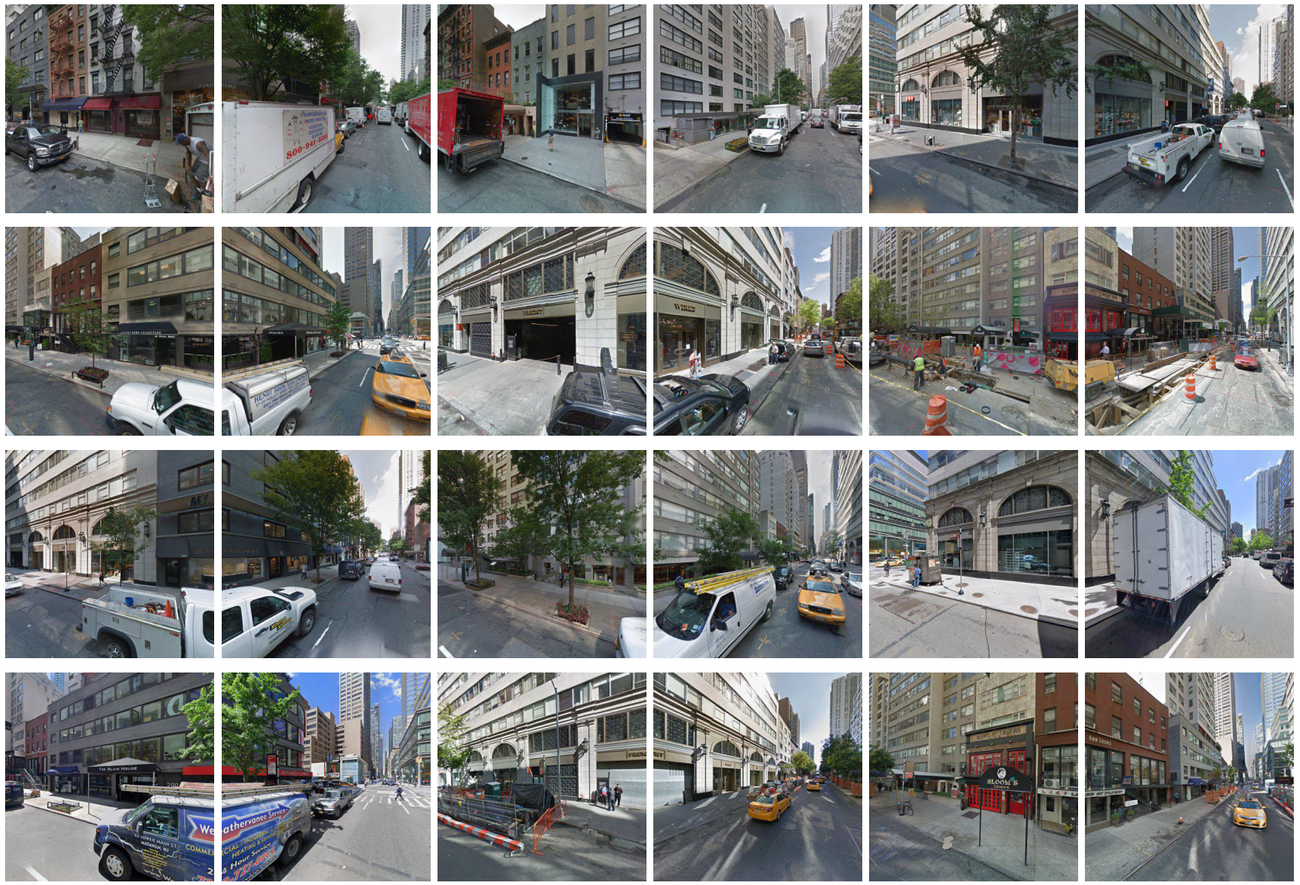
WA2_F1AX_BinOfInputAddress
1038623

Green View Index (80m radius)
0.00907472 (mean of all green view indexes)

Rank (out of 1467 samples)
393

Address
979 3rd Ave

Number of GSV dots
64



Can we measure how "green" the street experience is?

What is the Green View Index?

At each assigned coordinate, we calculated the average percentage of green pixels from collected Google Street View images that were taken from April to October in New York City.

WA2_F1AX_BinOfInputAddress
1008956

Green View Index (80m radius)
0.032094393

Rank (out of 1467 samples)
38

Address
61 4th Ave

Number of GSV dots
257

Can we measure how "green" the street experience is?

What does the Green View Index measure?

The visually perceived density of greenery at the street-level.

GSV Images

Processed Images

High — **Low**

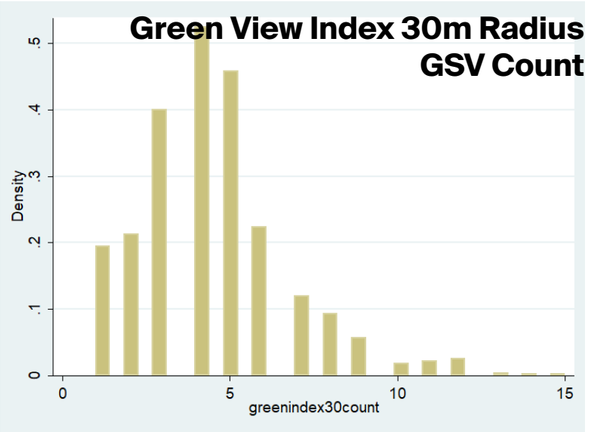
Can we measure how "green" the street experience is?

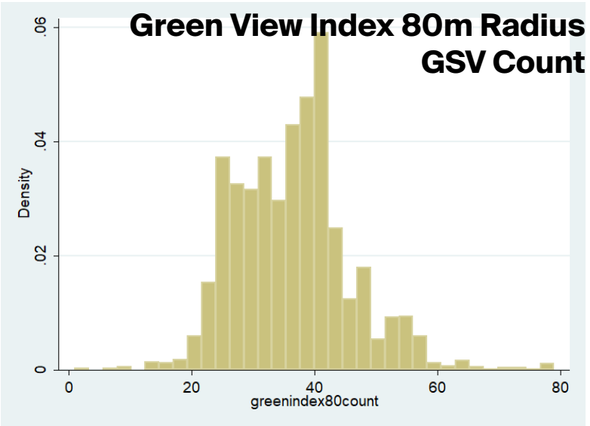
What does the Green View Index measure?

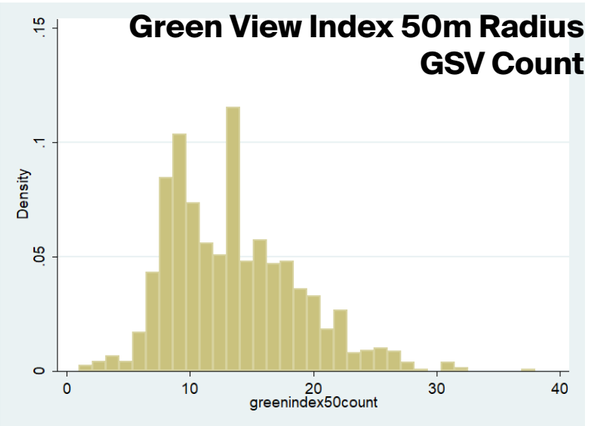
The visually perceived density of greenery at the street-level.

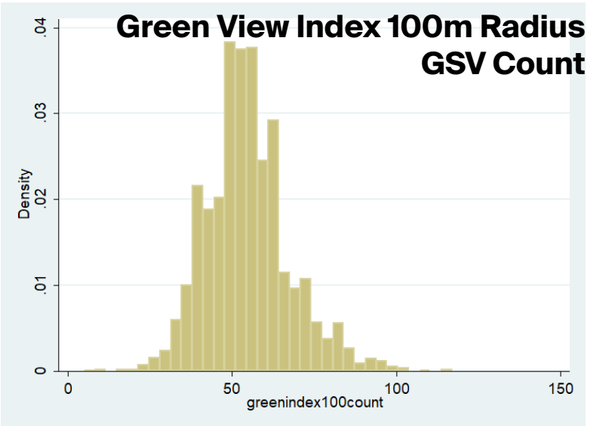
Selecting the Viable Green View Index

We compared the total number of Google Street View coordinates for each buffer area and decided to rule out the 30m-radius dataset due to its insufficient data.









Selecting the Viable Green View Index

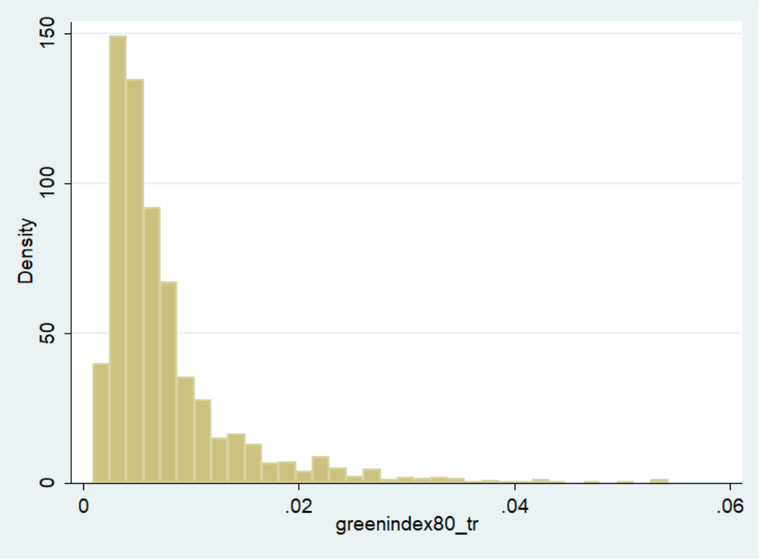
Selecting the viable green view index dataset that we should focus on required us to go beyond comparing numeric values.

Green View Index (50m) Summary

Obs	2794		
Sum of Wgt.	2794		
Mean	.0074207		
Std. Dev.	.0077398		
Variance	.0000599		
Skewness	3.215995		
Kurtosis	17.37664		

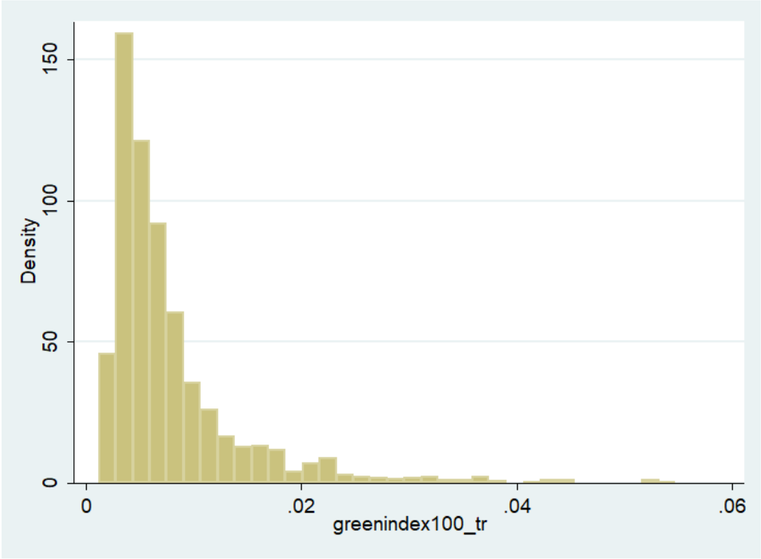
Green View Index (80m) Summary

Obs	2792		
Sum of Wgt.	2792		
Mean	.007583		
Std. Dev.	.0064139		
Variance	.0000411		
Skewness	2.783291		
Kurtosis	13.60012		



Green View Index (100m) Summary

Obs	2800		
Sum of Wgt.	2800		
Mean	.0078705		
Std. Dev.	.0064895		
Variance	.0000421		
Skewness	2.758046		
Kurtosis	13.22911		



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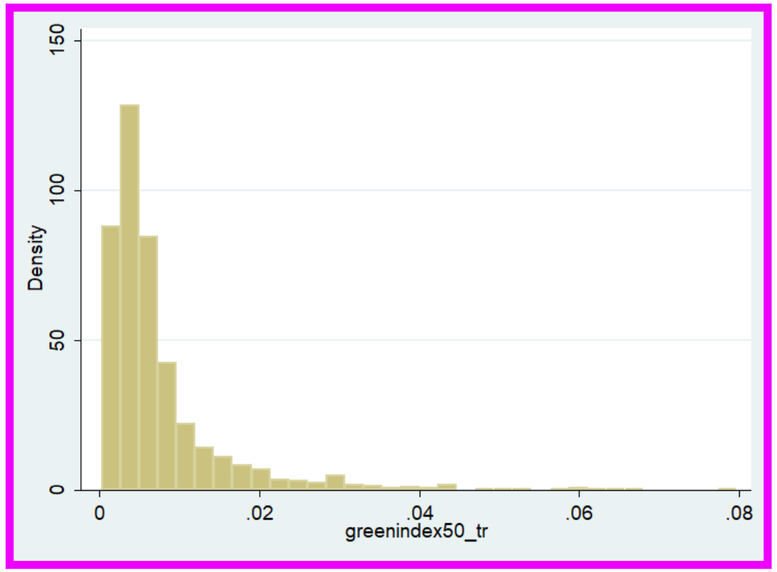

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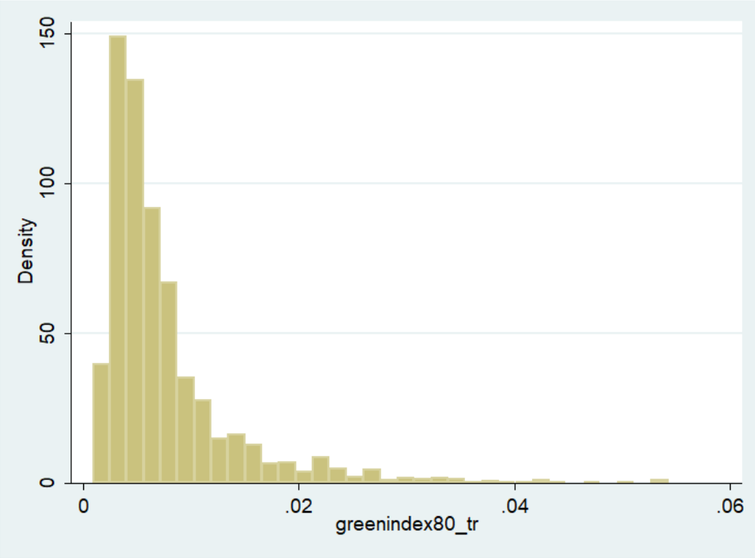

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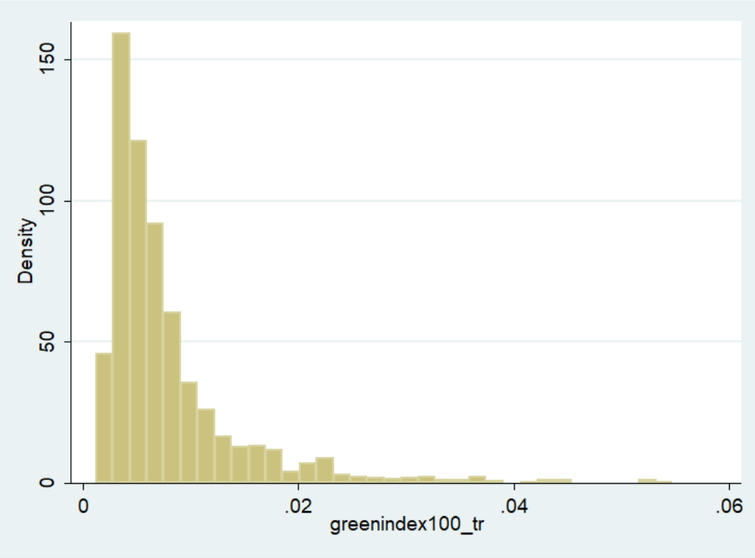
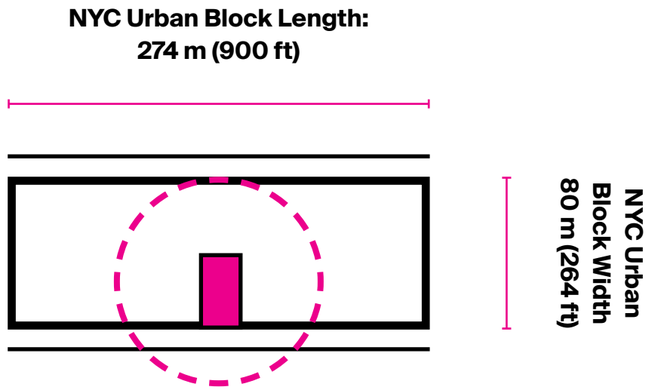
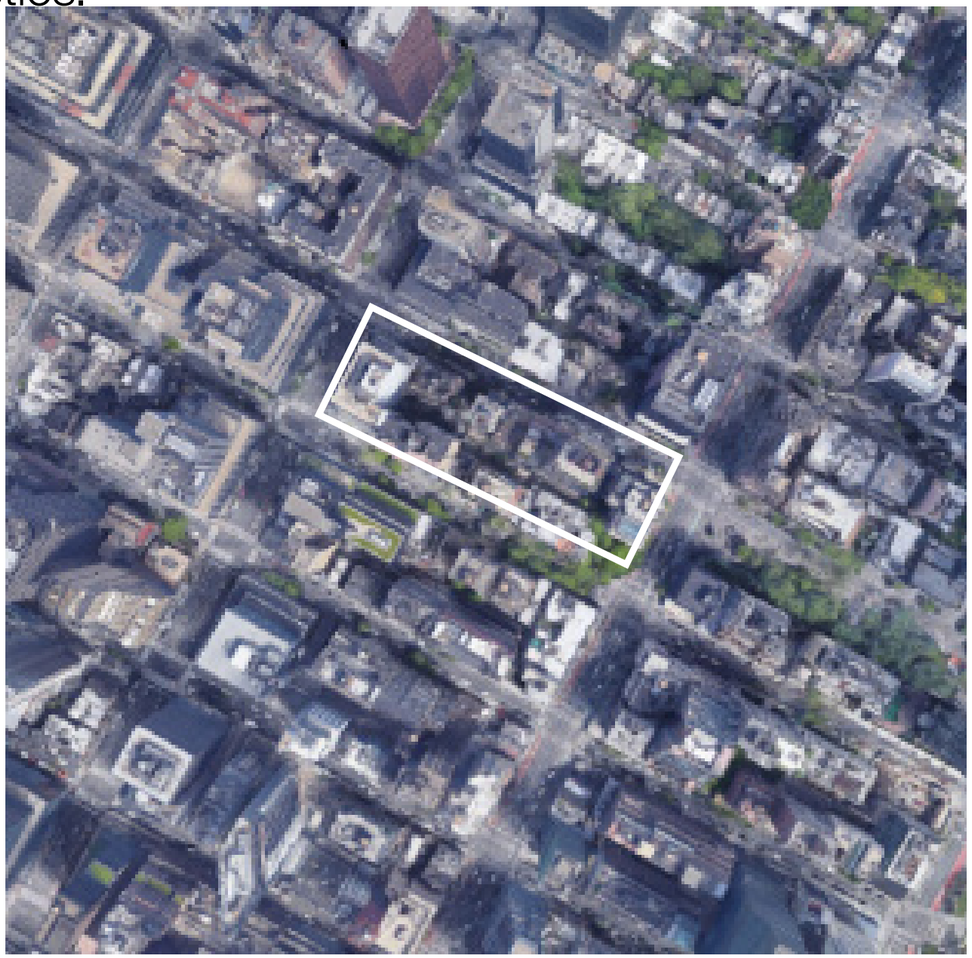


A buffer area with 50m radius is a site-specific choice for the Manhattan blocks.

Green View Index (50m Radius)

Selecting the viable green view index dataset that we should focus on required us to go beyond comparing numeric characteristics.





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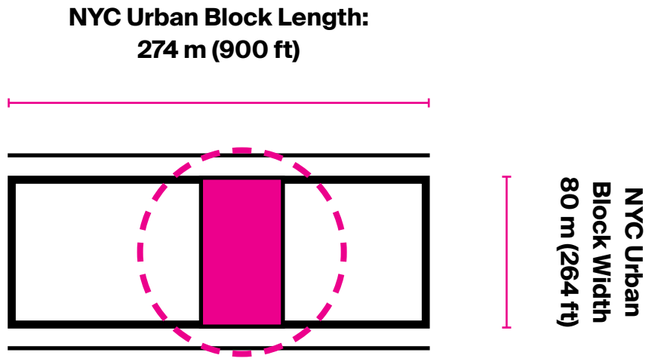

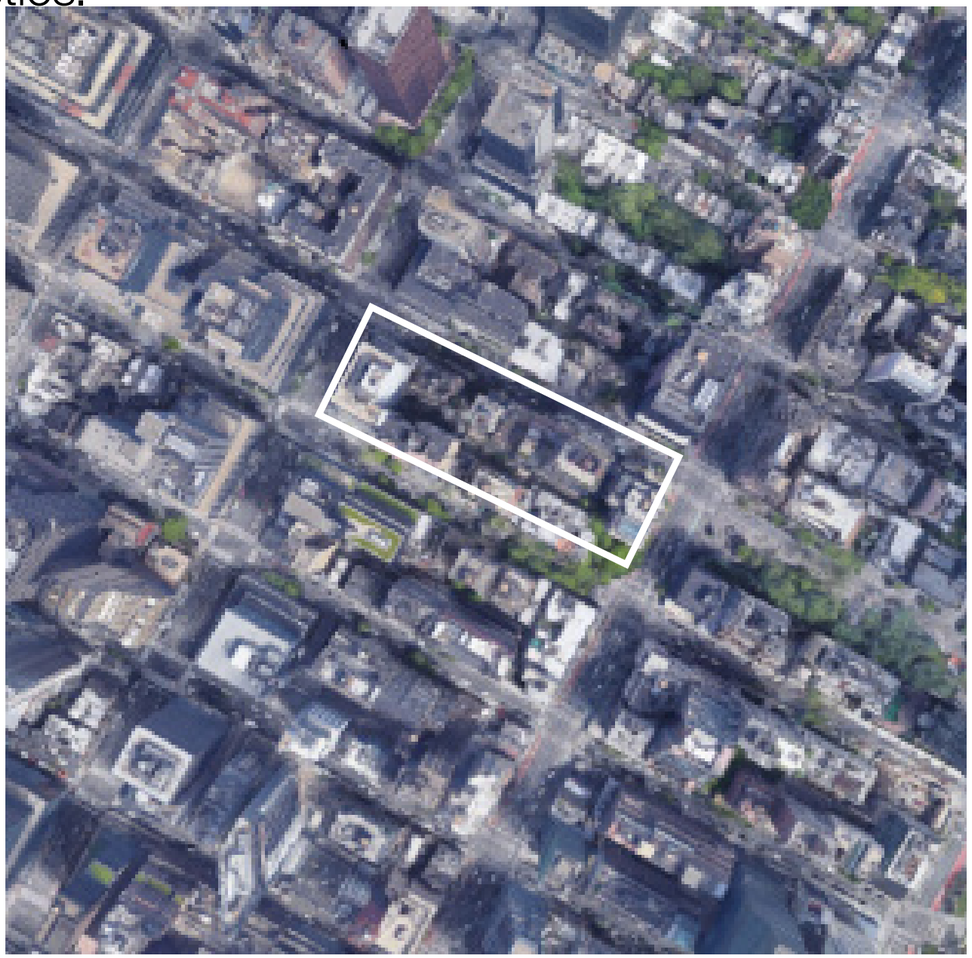

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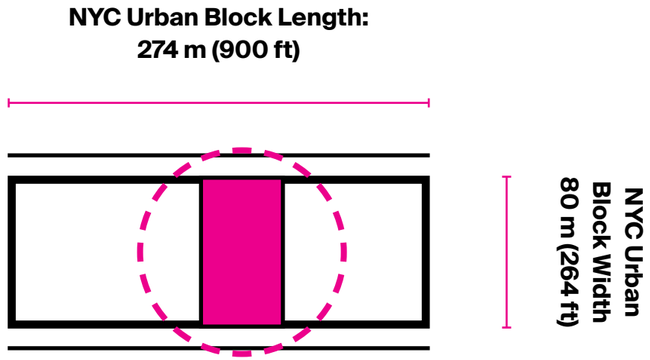
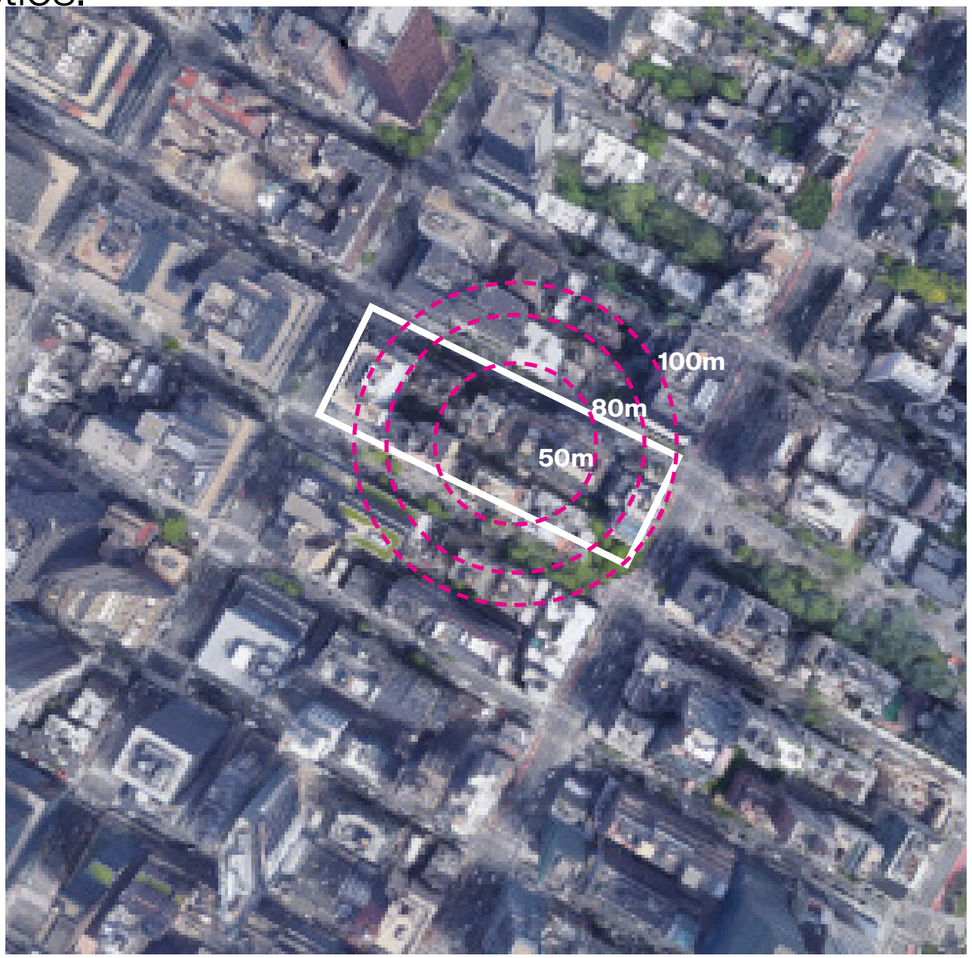




Green View Index (50m Radius)

Analyzing the green view index through different value categories.

Very Low
Green View Index 50m
Quartile==1

Obs	699
Sum of Wgt.	699
Mean	.0021561
Std. Dev.	.0005631
Variance	3.17e-07
Skewness	-.6277065
Kurtosis	2.772974

Low
Green View Index 50m
Quartile==2

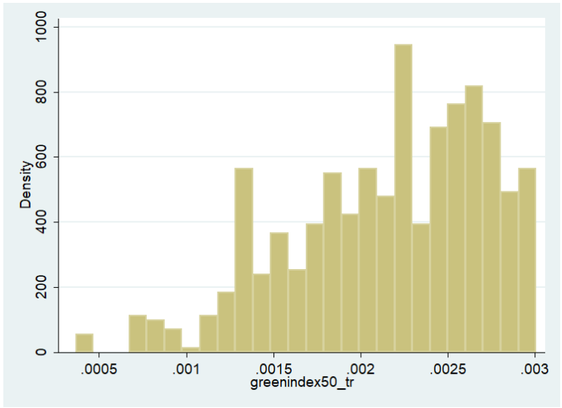
Obs	699
Sum of Wgt.	699
Mean	.0039976
Std. Dev.	.0005676
Variance	3.22e-07
Skewness	.0181935
Kurtosis	1.770768

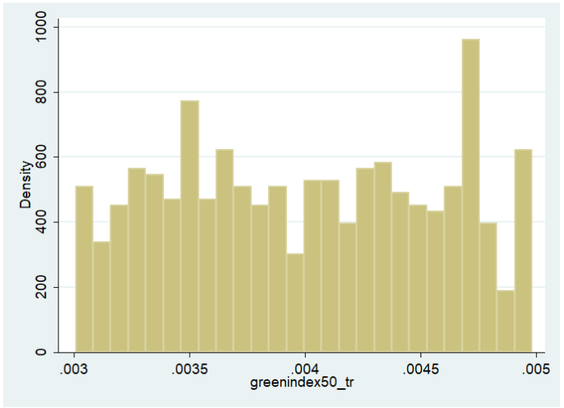
Medium
Green View Index 50m
Quartile==3

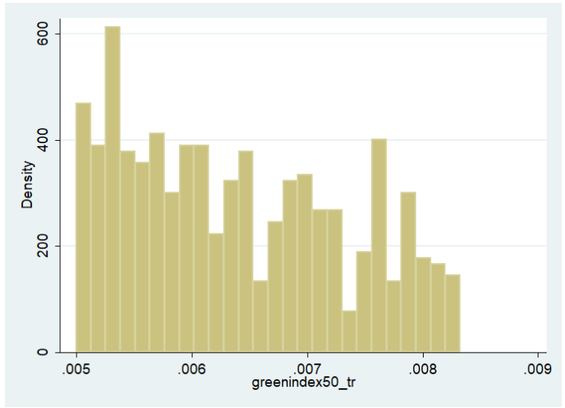
Obs	699
Sum of Wgt.	699
Mean	.0063914
Std. Dev.	.0009465
Variance	8.96e-07
Skewness	.3347948
Kurtosis	1.910803

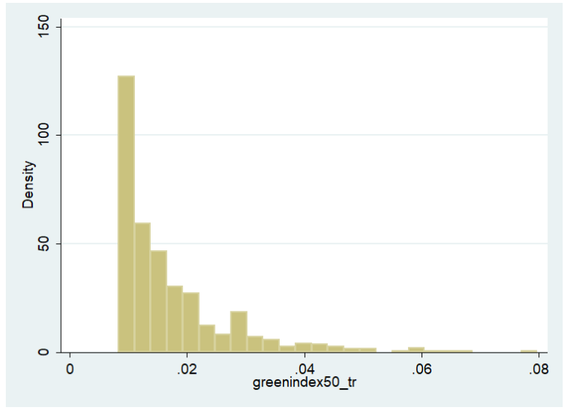
High
Green View Index 50m
Quartile==4

Obs	697
Sum of Wgt.	697
Mean	.0171655
Std. Dev.	.0101531
Variance	.0001031
Skewness	2.142692
Kurtosis	8.861019





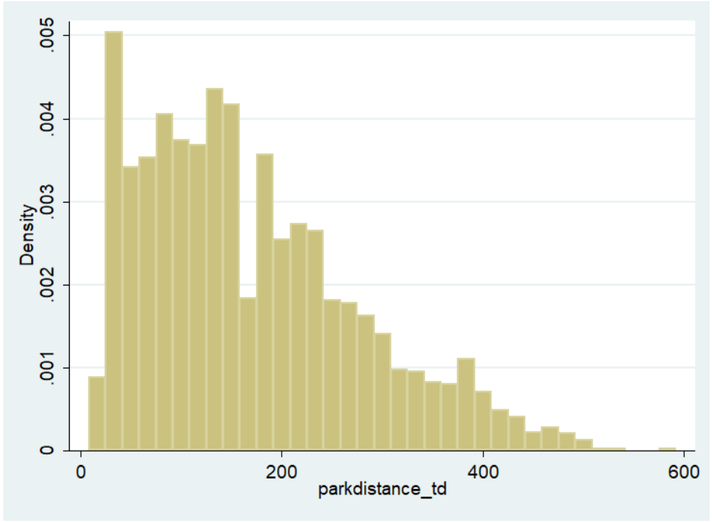




We also included other relevant variables that related to urban greenery studies - the distances to the closest park and metro station.

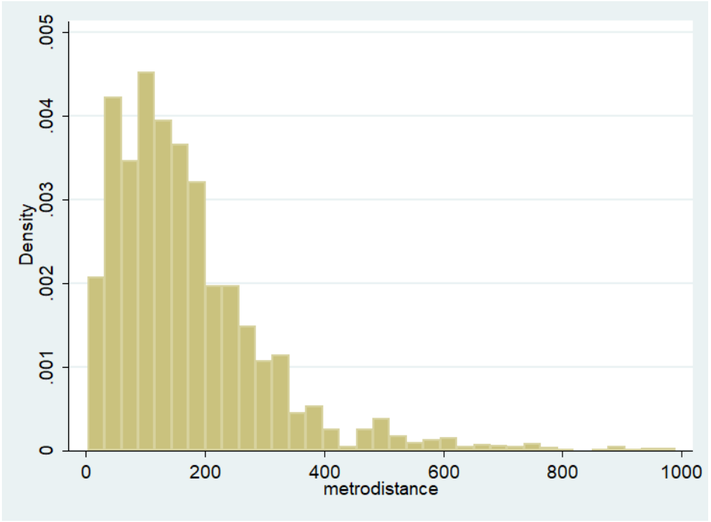
Relevant Variables

Park Distance



Obs	3209
Sum of Wgt.	3209
Mean	169.5832
Std. Dev.	108.0166
Variance	11667.58
Skewness	.7907341
Kurtosis	3.030394

Metro Distance

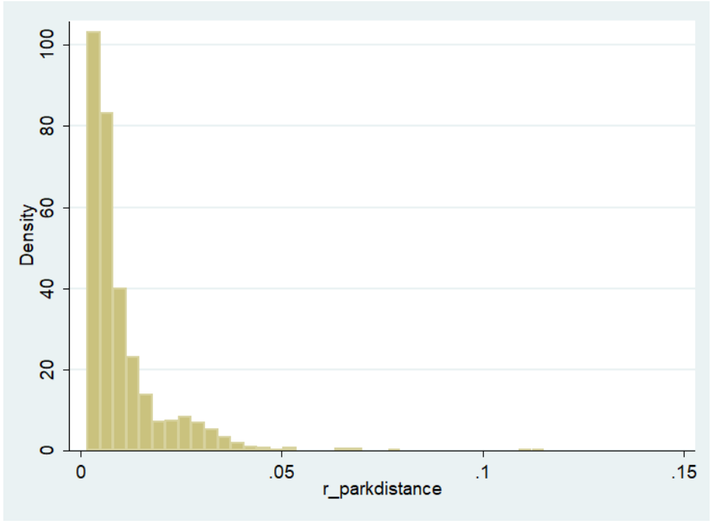


Obs	3213
Sum of Wgt.	3213
Mean	171.1437
Std. Dev.	131.0948
Variance	17185.85
Skewness	1.930016
Kurtosis	8.714695

We also included other relevant variables that related to urban greenery studies - the distances to the closest park and metro station.

Relevant Variables

Inverse Park Distance



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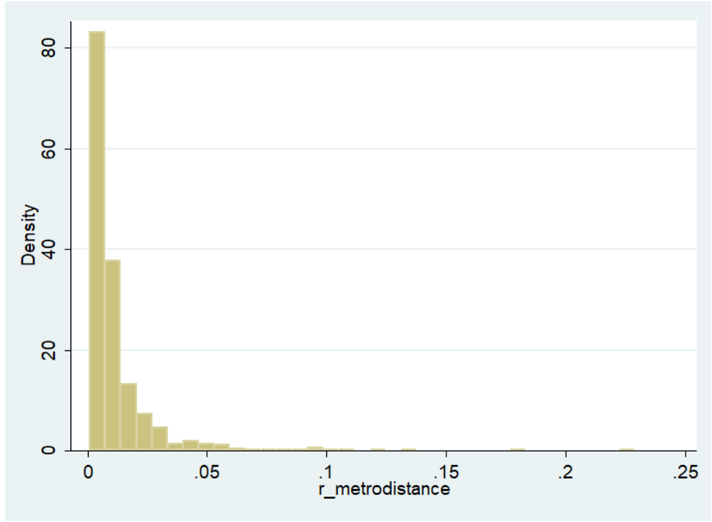
Inverse Metro Distance



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Incorporating context-specific considerations.

Accounting for External Factors - Business Improvement Districts (BIDs)

NOTE

- A Business Improvement District is a formal organization made up of property owners and commercial tenants who are dedicated to promoting business development and improving an area's quality of life. BIDs deliver supplemental services such as sanitation and maintenance, public safety and visitor services, marketing and promotional programs, capital improvements, and beautification for the area – all funded by a special assessment paid by property owners within the district.
- In our dataset, there are over 1900 samples (out of 3213 samples) that are within BIDs in Manhattan.
- While some BIDs invest generously into streetscape maintenance and beautification, some BIDs deploy the their funds to focus on other aspects of business improvement.

NYC BID HIGHLIGHTS

Envisioning and developing the future of the public realm

New Public Space in a Changing Neighborhood

Located in the historic printing district with little existing green space or trees, **Hudson Square** has planned, funded, and implemented several transformative streetscape projects. In fall 2018, the BID marked the completion and opening of Spring Street Park. After remaining untouched since the 1970s, the park now features custom swivel chairs, under-lit benches, movable furniture, and free public WiFi. Together, the City and BID invested $6 million, and the BID now maintains the new public space. Going forward, the BID will continue to complete its district-wide streetscape plan with funding from a long-term, $9 million bond issued in FY19.

Improving the Pedestrian Experience

With the opening of the first phase of the Hudson Yards megaproject in spring 2019, **Hudson Yards Hell's Kitchen Alliance** has been focused on streetscape improvements for the entire neighborhood. In addition to maintaining Bella Abzug Park, adjacent to the development's private plaza and Vessel, the BID completed capital projects on 36th and 37th streets. With more pedestrian-friendly designs, seating, and planters, both blocks serve as green oases in the middle of Hell's Kitchen and welcoming entrances to the west side of the district. In addition, the BID facilitated the painting of two murals on a Port Authority bridge and incorporated a public art piece made by a local Hell's Kitchen artist.

26 NYC BID HIGHLIGHTS

Photo credits: Ryan Muir for Hudson Square; Kristin West for Hudson Yards Hell's Kitchen Alliance

Using RCA and Compstak data we examine the transaction characteristics of commercial buildings in New York

Descriptive Statistics

A sample of 2,641 transaction records of commercial buildings in New York over the 2001-2018 period.

NOTE

- We use commercial building transaction data provided by Real Capital Analytics (RCA) and feature data from Compstak to provide fundamental hedonic variables for our pricing model and test the model in New York City.
- Compstak provides crowdsourced information such as lease contract characteristics, tenant profile, and market variables from verified professionals from commercial brokerage and appraisal firms.
- DATA SOURCES:
  - Real Capital Analytics
  - Compstak
  - NYC DoITT
  - NYC Planning

		Buildings with a Very Low Green View Index (Quartile 1)		Buildings with a Low Green View Index (Quartile 2)		Buildings with a Medium Green View Index (Quartile 3)		Buildings with a High Green View Index (Quartile 4)	
	Variable	Mean	(Std. Dev.)	Mean	(Std. Dev.)	Mean	(Std. Dev.)	Mean	(Std. Dev.)
Park and Metro Distances	parkdistance	182	(107.41)	180.44	(110.6)	173.86	(114.39)	143.44	(96.75)
	metrodistance	146.13	(107.15)	151.57	(116.59)	168.19	(124.28)	215.69	(158.92)
	r_parkdistance	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)
	r_metrodistance	0.01	(0.01)	0.01	(0.02)	0.01	(0.01)	0.01	(0.02)
Pricing	logPSF	6.08	(0.68)	6.17	(0.67)	6.22	(0.61)	6.31	(0.68)
	Price	119,700,432.99	(200,581,959.10,000	154,437,679.91	(383,328,112.20,000	170,686,507.82	(334,834,962.20,000	153,015,414.11	(301,730,198.0,000
Design Metrics	Curvy_Dummy	0	(0)	0	(0.04)	0.02	(0.13)	0.01	(0.08)
	Diagonal_Dummy	0.05	(0.23)	0.07	(0.25)	0.04	(0.2)	0.02	(0.13)
	Zoning_Dummy	0.21	(0.4)	0.16	(0.37)	0.21	(0.41)	0.09	(0.29)
	Podium_Dummy	0.04	(0.2)	0.05	(0.21)	0.05	(0.22)	0.12	(0.32)
BID Dummy	In-BID_Dummy	0.75	(0.43)	0.64	(0.48)	0.62	(0.48)	0.43	(0.5)
Building Attributes	Age	78.63	(29.95)	81.08	(30.13)	73.96	(31.36)	72.72	(32.04)
	Number Floors	17.95	(12.33)	17.22	(13.66)	17.5	(12.7)	15.6	(14.16)
	SqFt_nb	274,460.7	(382,029.55))	239,309.56	(379,013.06) 3	296,316.88	(458,175.6) 1	266,913.62	(452,176.24))
	Class A	0.13	(0.34)	0.19	(0.39)	0.22	(0.42)	0.36	(0.48)
	Class B	0.37	(0.48)	0.32	(0.47)	0.29	(0.45)	0.29	(0.46)
	Class C	0.08	(0.27)	0.09	(0.29)	0.1	(0.3)	0.08	(0.28)
	Class Unknown	0.42	(0.49)	0.4	(0.49)	0.39	(0.49)	0.26	(0.44)
	Renovated	0.25	(0.43)	0.15	(0.36)	0.14	(0.35)	0.18	(0.38)

Explaining Transaction Prices

We employ a regression framework to explain transaction price with a series of relevant variables.

NOTE

Estimation Strategy:

- We estimate a hedonic model, with robust standard errors;
- We control for special features of the transaction event such as buyer, seller, and lender types;
- We also control for location and time of the transactions.

We estimated a semi-log linear regression model where we explain the transaction price per square meter for a given building (i) as a cross-section, where (X_i), building features, time and location fixed effects (BID locations, sub-market, etc.), buyer, seller and lender types and (G_i) is the vector of green view index variables, divided by quartiles and classified as four levels - Very Low (quartile 1), Low (quartile 2), Medium (quartile 3), and High (quartile 4).

$$logP_i = \alpha + \beta X_i + \delta G_i + \varepsilon$$

The explanatory variable is the transaction price per square meter for a given building. We observe individual transactions over the 2011 to 2018 period across Manhattan, New York. The time period overlaps with the period during which Google Map took street view images.

results of the hedonic model explain between 46 and 51 percent of the effective rent per square meter

Results

We explain the log transaction price per square meters by location and time, building features and transaction features fixed effects.

VARIABLES	GVI Quartiles (1)	With Park Subway Distances (2)	With Design Metrics (3)	With BID (1=YES) (4)	With BID Neighborhoods (5)
Street-Level Greenness					
GVI Low	0.054*	0.047	0.042	0.043	0.007
	[0.029]	[0.029]	[0.028]	[0.028]	[0.028]
GVI Medium	0.073***	0.064**	0.061**	0.063**	0.047*
	[0.027]	[0.027]	[0.027]	[0.027]	[0.028]
GVI High	0.099***	0.086***	0.064**	0.068**	0.062**
	[0.029]	[0.029]	[0.029]	[0.030]	[0.030]
Park and Subway Distances					
Park Distance (1/r)		3.563***	3.074***	3.038***	2.136**
		[1.006]	[1.033]	[1.039]	[1.043]
Subway Distance (1/r)		1.640**	1.566**	1.522**	1.754**
		[0.719]	[0.719]	[0.722]	[0.710]
Design Metrics					
Curvature			0.141	0.140	0.143
			[0.086]	[0.086]	[0.089]
Diagonality			0.048	0.047	0.081
			[0.049]	[0.049]	[0.049]
Setbacks			-0.097***	-0.099***	-0.077***
			[0.027]	[0.028]	[0.027]
Podium Extrusion			0.166***	0.165***	0.094*
			[0.049]	[0.049]	[0.048]

VARIABLES	GVI Quartiles (1)	With Park Subway Distances (2)	With Design Metrics (3)	With BID (1=YES) (4)	With BID Neighborhoods (5)
Location Transaction Time FE	YES	YES	YES	YES	YES
Transaction Features FE	YES	YES	YES	YES	YES
Constant	7.556***	7.866***	7.691***	7.743***	7.677***
	[0.842]	[0.849]	[0.861]	[0.865]	[0.867]
Observations	2,641	2,641	2,641	2,641	2,641
R-squared	0.472	0.476	0.483	0.483	0.528
Building Features FE	YES	YES	YES	YES	YES
F Adj R-Squared	0.46	0.46	0.47	0.47	0.51

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

SIGNIFICANCE***

Asterisks in a regression table indicate the level of the statistical significance of a regression coefficient.

*** p<0.01, ** p<0.05, * p<0.1

COEFFICIENT %

The standard error is our estimate of the standard deviation of the coefficient.

NOTE:

The regression model controls for location and transaction time, building features (age, number of floors, building area, land parcel area, building class, renovation, and walk score), and transaction features (buyer type, seller type, and lender type)

DATA SOURCES:

- Real Capital Analytics
- Compstak
- NYC DoITT
- NYC Planning

Accounting for External Factors - Business Improvement Districts (BIDs)

Using a "pure sample" by eliminating overlapping features in the dataset

NOTE

- A Business Improvement District is a formal organization made up of property owners and commercial tenants who are dedicated to promoting business development and improving an area's quality of life. BIDs deliver supplemental services such as sanitation and maintenance, public safety and visitor services, marketing and promotional programs, capital improvements, and beautification for the area – all funded by a special assessment paid by property owners within the district.
- In our dataset, there are over 1900 samples (out of 3213 samples) that are within BIDs in Manhattan, New York City.

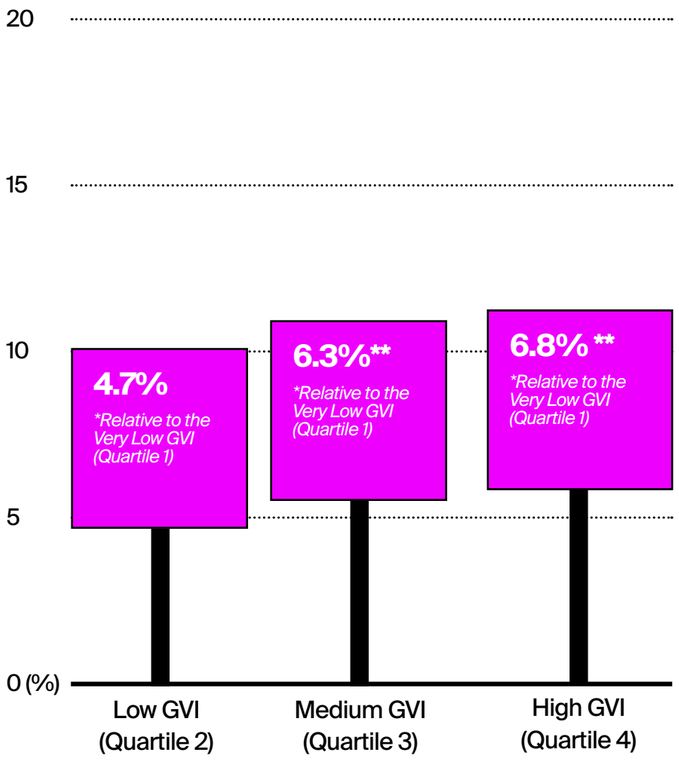
	GVI Quartiles	With Park Subway Distances	With Design Metrics		With BID (1=YES)	With BID Neighborhoods
VARIABLES	1	2	3	4	5	6
quartile50== 2.0000		0.054*	0.047	0.042	0.043	0.007
		[0.029]	[0.029]	[0.028]	[0.028]	[0.028]
quartile50== 3.0000		0.073***	0.064**	0.061**	0.063**	0.047*
		[0.027]	[0.027]	[0.027]	[0.027]	[0.028]
quartile50== 4.0000		0.099***	0.086***	0.064**	0.068**	0.062**
		[0.029]	[0.029]	[0.029]	[0.030]	[0.030]
r_parkdistance			3.563***	3.074***	3.038***	2.136**
			[1.006]	[1.033]	[1.039]	[1.043]
r_metrodistance			1.640**	1.566**	1.522**	1.754**
			[0.719]	[0.719]	[0.722]	[0.710]
Curvy_Dummy				0.141	0.140	0.143
				[0.086]	[0.086]	[0.089]
Diagonal_Dummy				0.048	0.047	0.081
				[0.049]	[0.049]	[0.049]
Zoning_Dummy				-0.097***	-0.099***	-0.077***
				[0.027]	[0.028]	[0.027]
Podium_Dummy				0.166***	0.165***	0.094*
				[0.049]	[0.049]	[0.048]
In-BID					0.014	
					[0.022]	
Chinatown						-0.167**
						[0.078]
Columbus Amsterdam BID						-1.180*
						[0.709]
Columbus Avenue BID						0.204
						[0.134]
Downtown Alliance BID						-0.347***
						[0.053]
East Mid-Manhattan BID						0.183***
						[0.059]
Flatiron/23rd Street Partnership						-0.008
						[0.043]
Garmen District						-0.181***
						[0.041]
Grand Central Partnership						0.038
						[0.042]
Hudson Square						-0.353***
						[0.095]
Hudson Yards/Hell's Kitchen						-0.150
						[0.141]
Lincoln Square BID						-0.007
						[0.130]
Lower East Side BID						-0.317*

results of the hedonic model explain between 46 and 51 percent of the effective rent per square foot

Results Overview

NOTE

- With the Very Low GVI (quartile 1) data as the base, the regression results indicate that the Medium GVI (quartile 3) and the High GVI (quartile 4) yield positively significant coefficients. In that sense, the results suggest real estate pricing primiums will emerge when the street-level greenness has reached a perceivable level.



When controlling for location and transaction time, building features and transaction features, the result of the hedonic analysis suggests that buildings surrounded by high-quality street-level greenness have a premium compared to those without.

DATA SOURCES:

- Real Capital Analytics
- Compstak
- NYC DoITT
- NYC Planning

SIGNIFICANCE***

Asterisks in a regression table indicate the level of the statistical significance of a regression coefficient.

*** p<0.01, ** p<0.05, * p<0.1

COEFFICIENT %

The standard error is our estimate of the standard deviation of the coefficient.

NOTE:

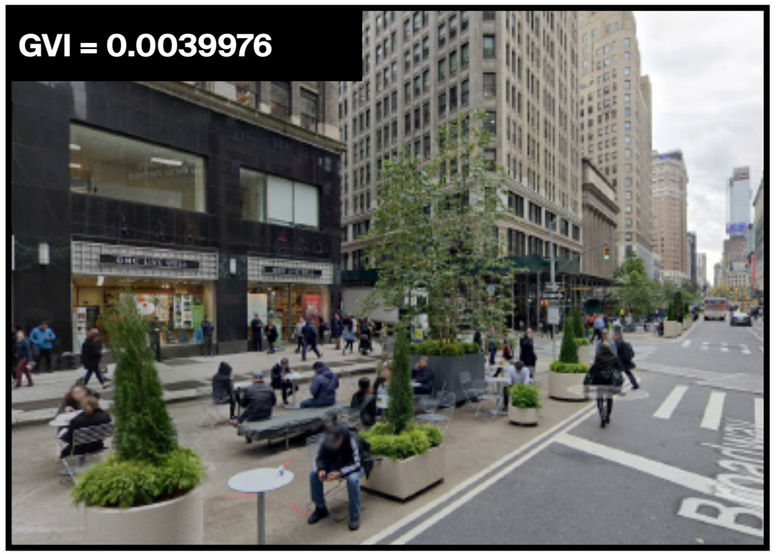
The regression model controls for location and transaction time, building features (age, number of floors, building area, land parcel area, building class, renovation, and walk score), and transaction features (buyer type, seller type, and lender type)

Visualize the green view index categories through Google Street View Images

Results with Visualization

Green View Index (50m) Quartile 2

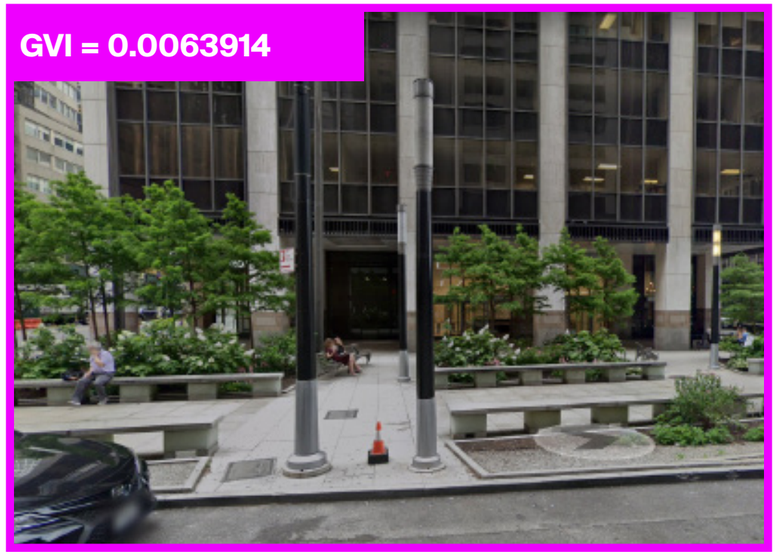
Obs	Mean	Std. Dev.	Min	Max
699	.0039976	.0005676	.0030078	.0049839



1373 Broadway, New York

Green View Index (50m) Quartile 3

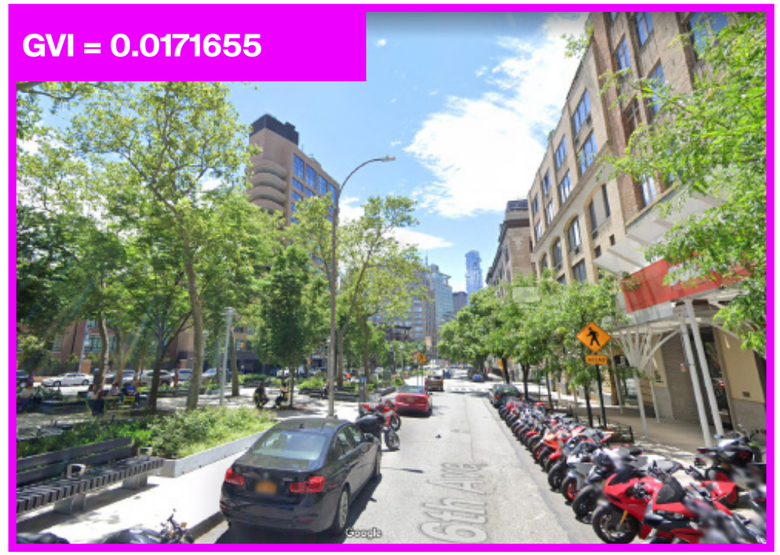
Obs	Mean	Std. Dev.	Min	Max
699	.0063914	.0009465	.0049964	.0083292



95 Wall Street, New York

Green View Index (50m) Quartile 4

Obs	Mean	Std. Dev.	Min	Max
697	.0171655	.0101531	.0083504	.0797365



145 Sixth Ave, New York

Conclusions

Why urban designers/ planners, developers, and city officials should both pay attention to this subject

NOTE

- CONTRIBUTION: This creates and expands understanding of the impact of street-level greeness on the value of real estate and a city.
- NEW DATASET: With increasing computational power to measure and assess the built environment, we can create new data (street-level greenness based on Google Street View images) to include in our pricing model.

Some Takeaways

Why urban designers/ planners, developers, and city officials should both pay attention to this subject

NOTE

- CONTRIBUTION: Our contribution is to create a relational understanding between street-level greenness and commercial real estate valuation techniques.
- NEW DATASET: With increasing computational power to measure and assess the built environment, we can create new data (street-level greenness based on Google Street View images) to include in our pricing model.

- **GVI as a measurable shift from greenery to greenness;**
- **Results suggest a positive transaction price premium between 4.7-6.3 percent for transactions in the highest quartile of GVI;**
- **The expanding role that image recognition has in the measurement of asset values.**
- **This research is a first from a commercial real estate standpoint. Practical implication is that corporate and institutional investment portfolios in office real estate are highly correlated with urban planning and institutional investment in the urban landscape;**
- **Real estate developers are incentivized to align with landscape architecture and urban planning experts on this value enhancing urban amenity.**