Assessing the Impact of Neighborhood Change to NYC's FRESH Program

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What is the FRESH program?

FRESH promotes neighborhood grocery store development through **zoning and tax incentives**, in areas zoned for FRESH through the Supermarket Needs Index.

FRESH

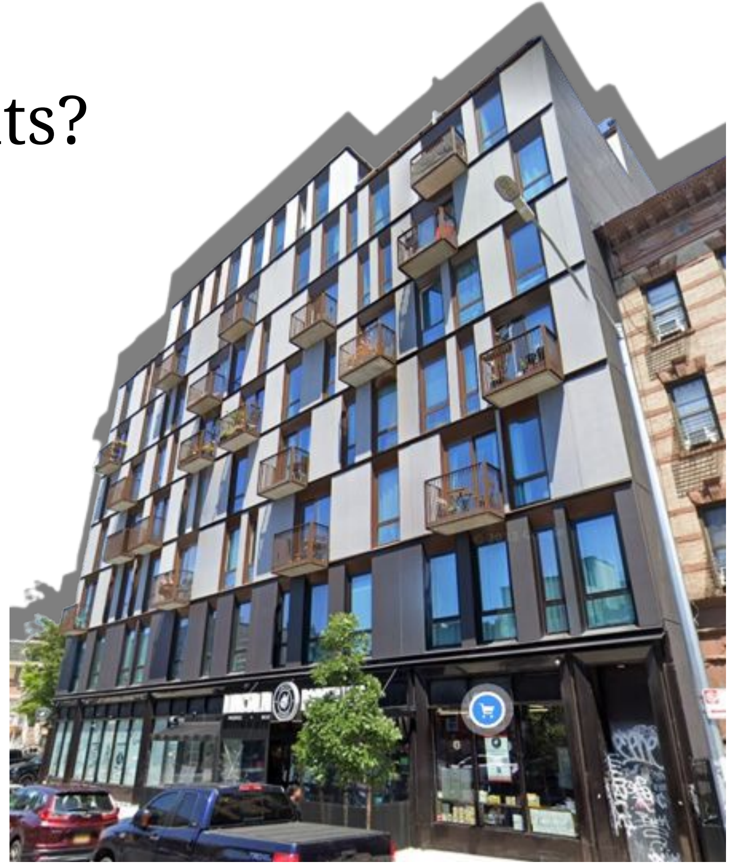
Food Retail Expansion to Support Health

How does this affect residents?

Over 50 stores have been approved under the FRESH program...

$140M invested in NYC's economy...

...but the power is in the developer's hands.



Source: 633 Marcy Ave, Google Street View (July 2022)

How could this program be improved?

Ensure a more equitable distribution of FRESH developments through deeper quantitative analysis of the implementation results from the last decade. (my thesis!)

DCP needs to assess additional indicators that may be a factor to FRESH store clustering.

Source: NYC Open Data, DCP Fresh Food Stores

Research Questions

1. Are FRESH developments in Brooklyn significantly clustered?

2. In Brooklyn and Bedford-Stuyvesant:

   What is the **impact of a neighborhood change indicator** to the likelihood of **creating a fresh zone** within a census tract?

   What is the impact of a neighborhood change indicator to the likelihood of **creating a fresh store** within a census tract?

Data Sources

NYC Open Data

FRESH zones [poly]

- BYTES of the BIG APPLE™ - Archive (2019)

FRESH food stores [point]

- DCP Open Data email request

Borough Boundaries [poly]

Community Districts [poly]

U.S Census Bureau

via Tidycensus :

2011-2019

Total Population

Race (white alone)

Median Household Income

Year Structure Built

Transform Data

Census Data

Change in household income, 2011-2019

Adjusted to 2019 inflation rates (where CPI 2019 / CPI 2011 = 1.143)

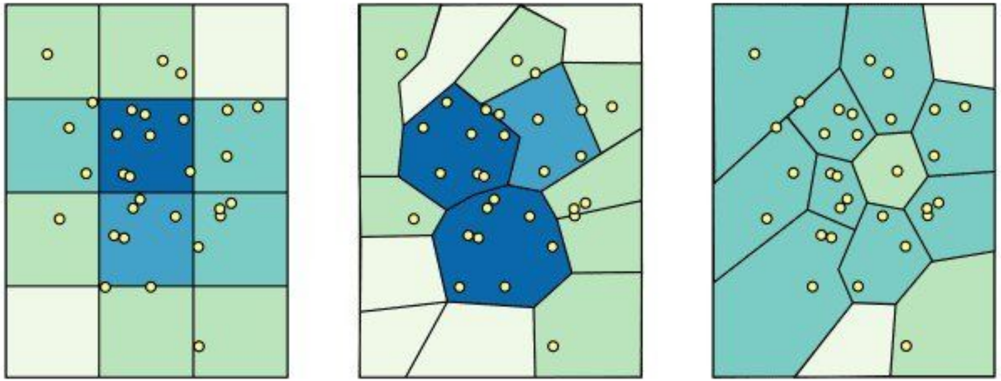
Change in white population, 2011-2019

Created % with total population rates (2011, 2019)

Census Data

Year Structure Built (where 'new buildings' are 2014 or later, 2019 only)

Normalize density to represent # **of new buildings** / **square mile**

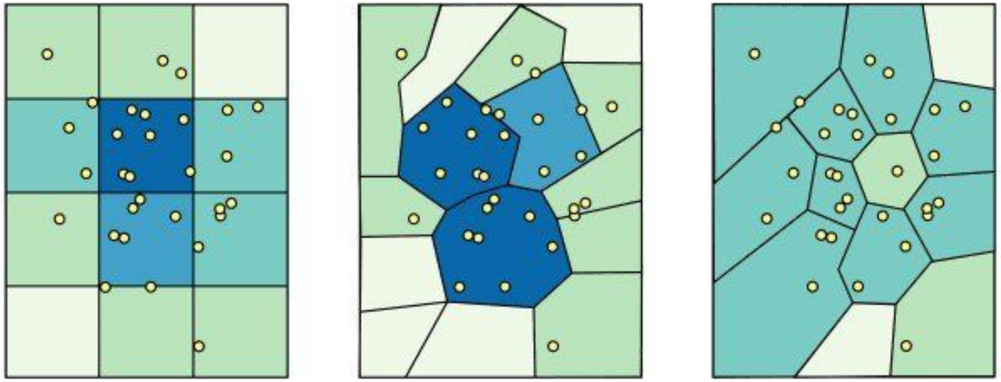


Source: Rafael H. Pereira, Urban Demographics

FRESH stores

Fresh Food Stores by census tract

Normalize density to represent # **of FRESH stores** / **square mile**



Source: Rafael H. Pereira, Urban Demographics

FRESH Binary Categories

Define census tracts that have a FRESH store

- calculated number of stores through a value_count of GEOID (unique ID)
- created binary category column where all tracts with at least one store were labeled '1'

FRESH Binary Categories

Define census tracts that are in a FRESH zone

- clipped fresh zone to brooklyn boundary
- joined census tracts that are only within the fresh zone, created a field to mark these tracts as "1"

- joined to full dataset, filled NAs to create 0/1 categories

Modeling

Part I: Moran's I on FRESH Food Stores

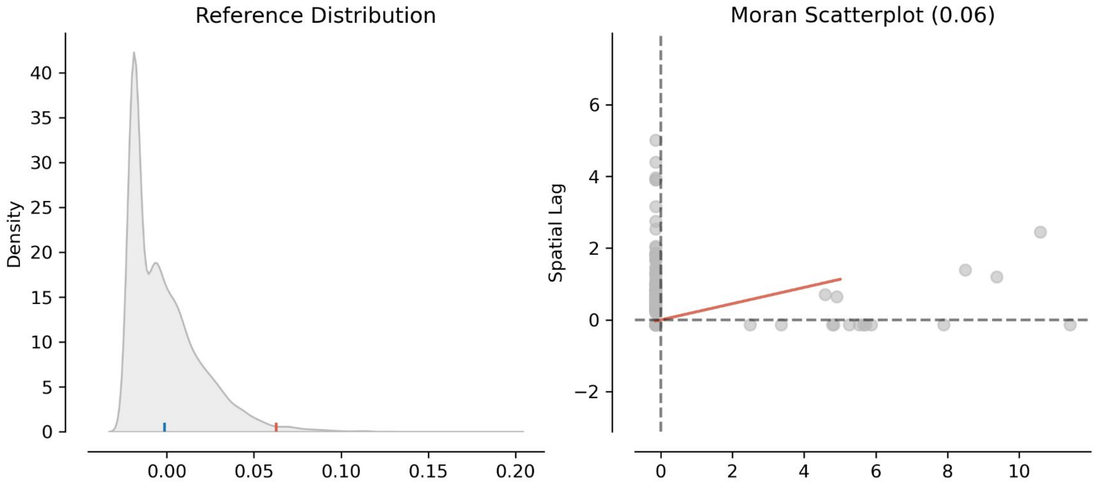
On Queen Contiguity

Global Moran

On normalized density of FRESH food stores in Brooklyn:

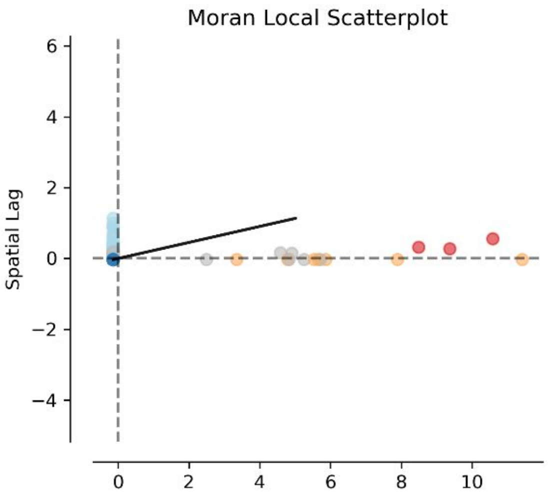
moran.I = 0.0627

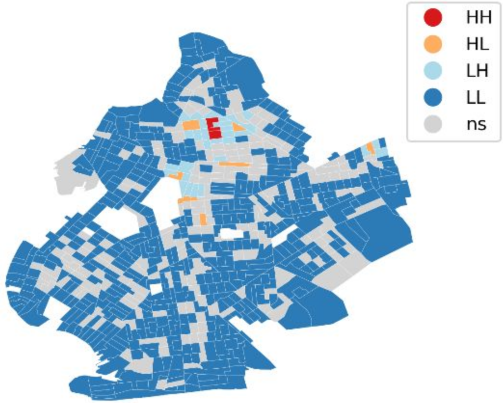
p-value = 0.013

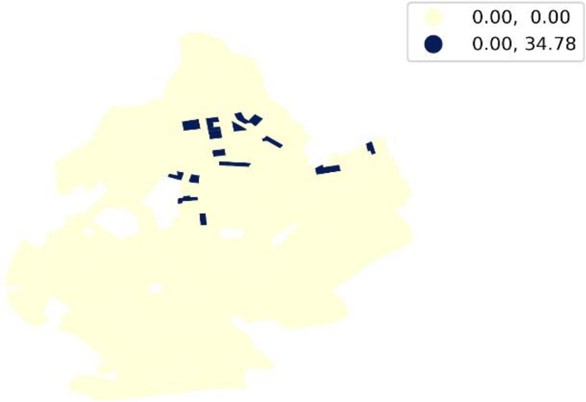


Local Moran

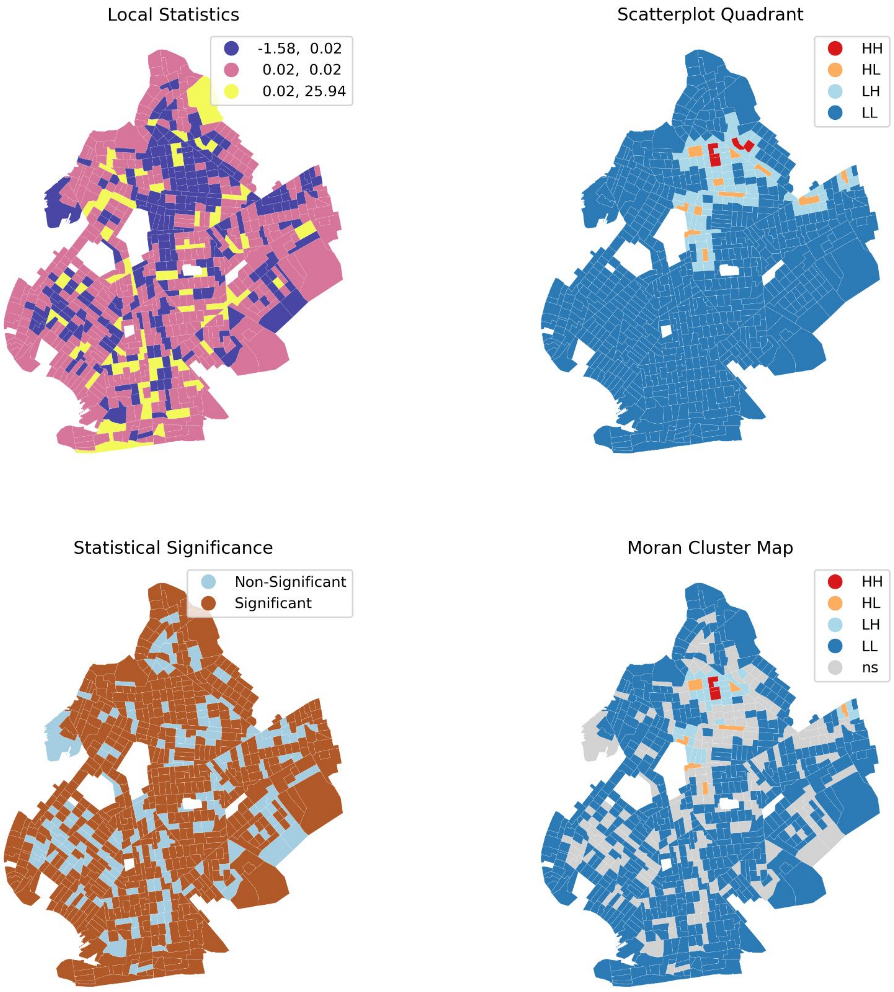
On normalized density of FRESH food stores in Brooklyn:







Local Moran



Local Statistics
-1.58, 0.02
0.02, 0.02
0.02, 25.94
Scatterplot Quadrant
HH
HL
LH
LL
Statistical Significance
Non-Significant
Significant
Moran Cluster Map
HH
HL
LH
LL
ns

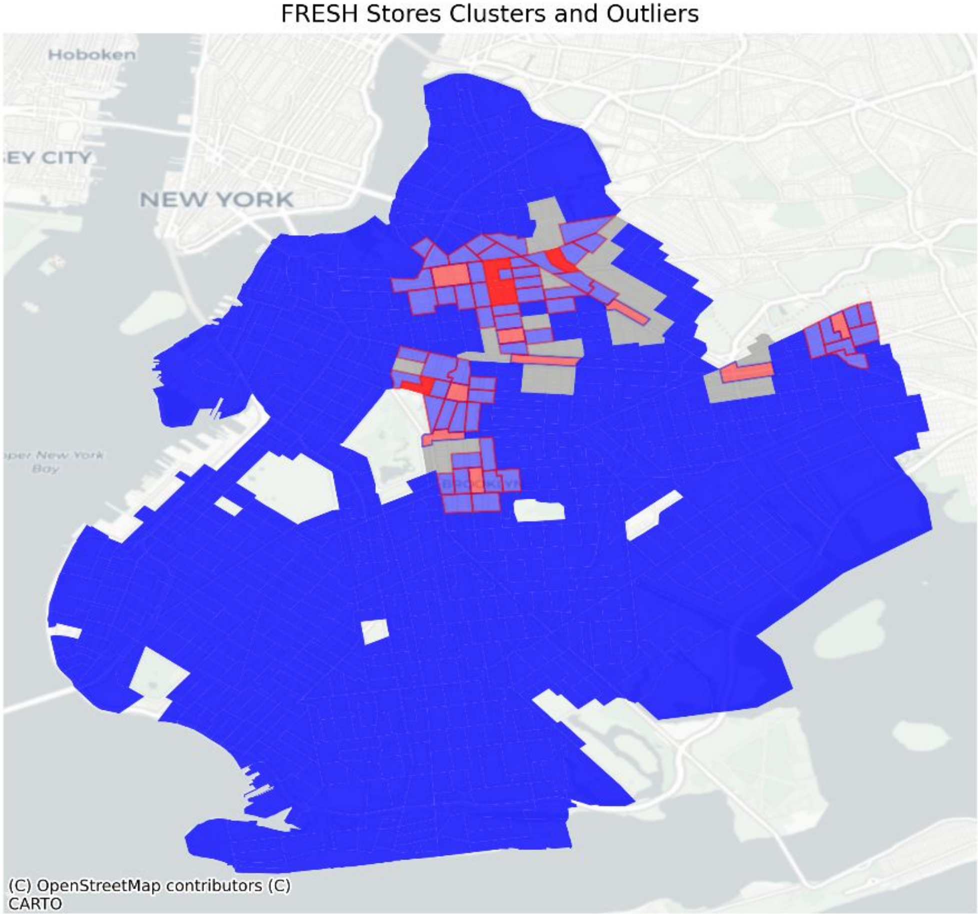
Local Moran

HOT SPOTS

COLD SPOTS

DIAMONDS

DOUGHNUTS



Part II:
Logistic Regression

Through sensitivity analyses

Models

1. FRESH zone Brooklyn
2. FRESH store Brooklyn
3. FRESH store Bedford-Stuyvesant

Understanding the results

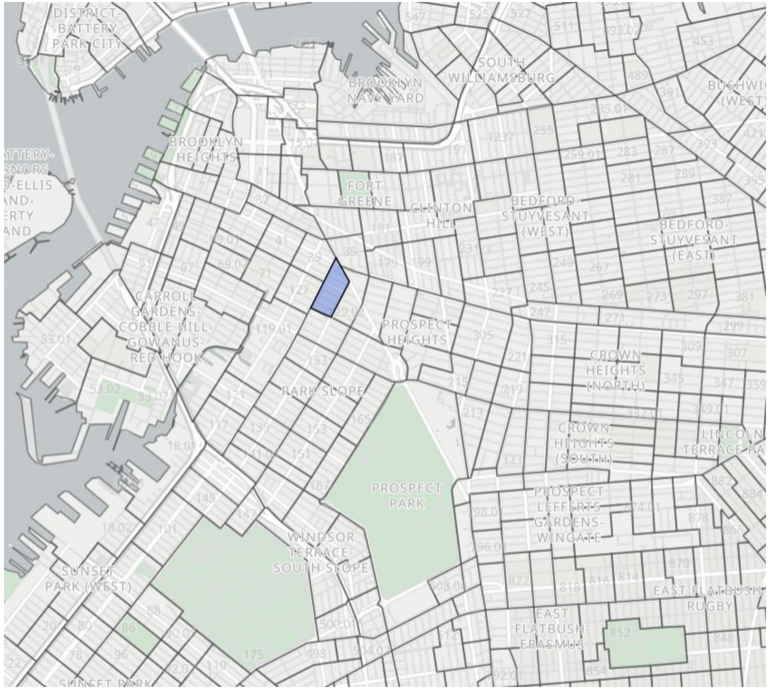
Logistic Regressions are NOT linear

Easier to interpret results in piecemeal fashion

- To do this, test changes in neighborhood indicators with one census tract

2 census rows, with different characteristic breakdowns, are selected as test variables

"Gentrified Test Variable": Census Tract 129.01



INFO-615

Source: NYCDCP Population Fact Finder

Spring 2023

“Not Gentrified” Test Variable: Census Tract 374.02

Source: NYCDCP Population Fact Finder

Model 1: Fresh Zones in Brooklyn

Predicting the likelihood of a census tract being considered in a fresh zone

Logit Regression Results

Dep. Variable:	fresh_zone	**No. Observations:**	745
Model:	Logit	**Df Residuals:**	741
Method:	MLE	**Df Model:**	3
Date:	Wed, 03 May 2023	**Pseudo R-squ.:**	0.05380
Time:	12:44:49	**Log-Likelihood:**	-461.04
converged:	True	**LL-Null:**	-487.25
Covariance Type:	nonrobust	**LLR p-value:**	2.425e-11

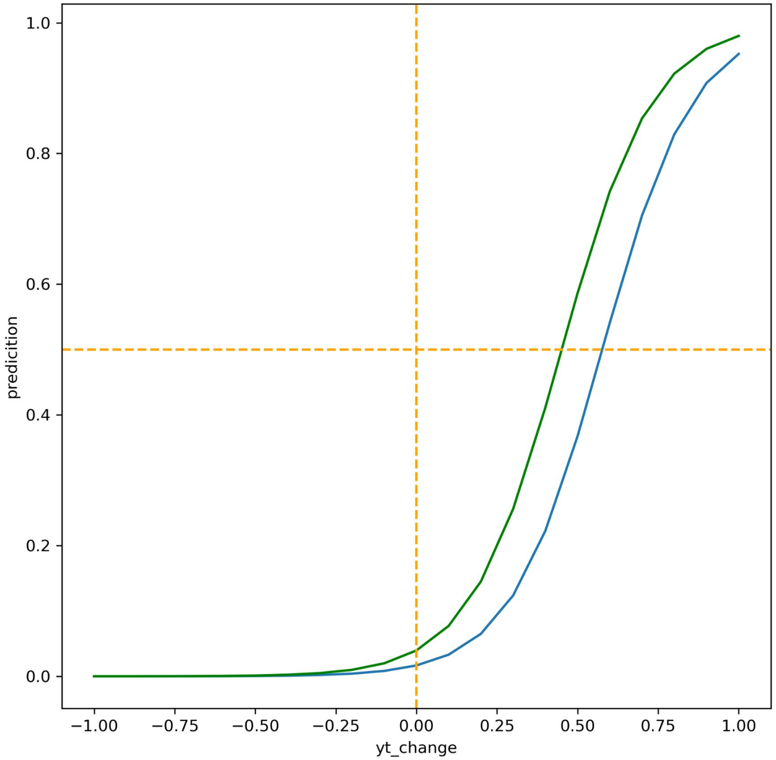
	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.2528	0.091	-2.783	0.005	-0.431	-0.075
inc_change	-3.304e-05	5.31e-06	-6.226	0.000	-4.34e-05	-2.26e-05
yt_change	2.2769	0.758	3.003	0.003	0.791	3.763
new_built	-4.265e-05	0.000	-0.335	0.738	-0.000	0.000

Model 1 Testing: Change in % of White Population

GENTRIFIED test variable

NON-GENTRIFIED test variable

Stronger predictions of a fresh zone based on white population changes are seen in the gentrified test variable.

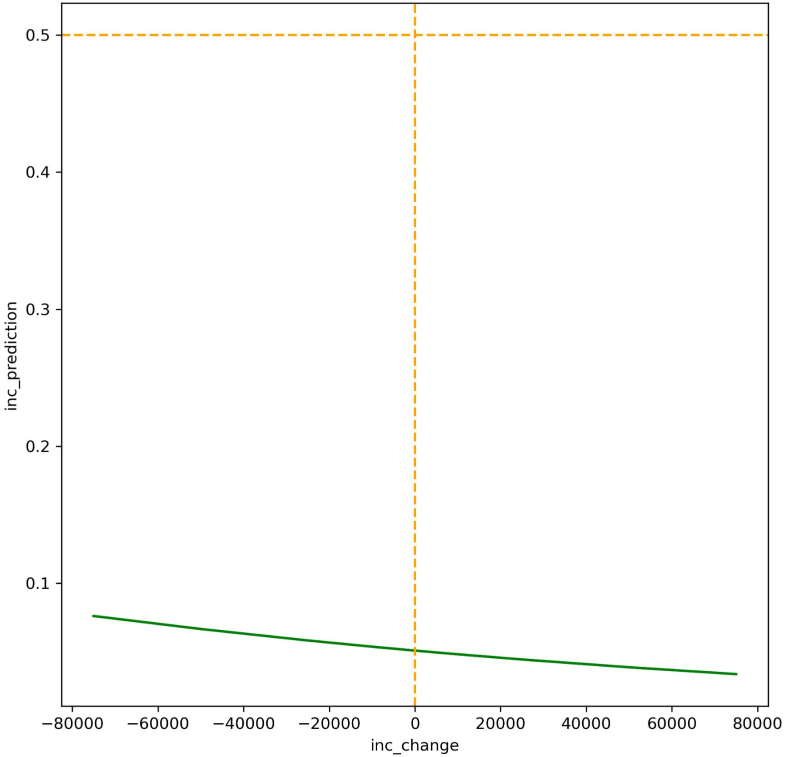


Model 1 Testing: Change in Household Income

GENTRIFIED test variable

NON-GENTRIFIED test variable (SAME)

Both variables decrease their predictions by the same rate as household income increases.

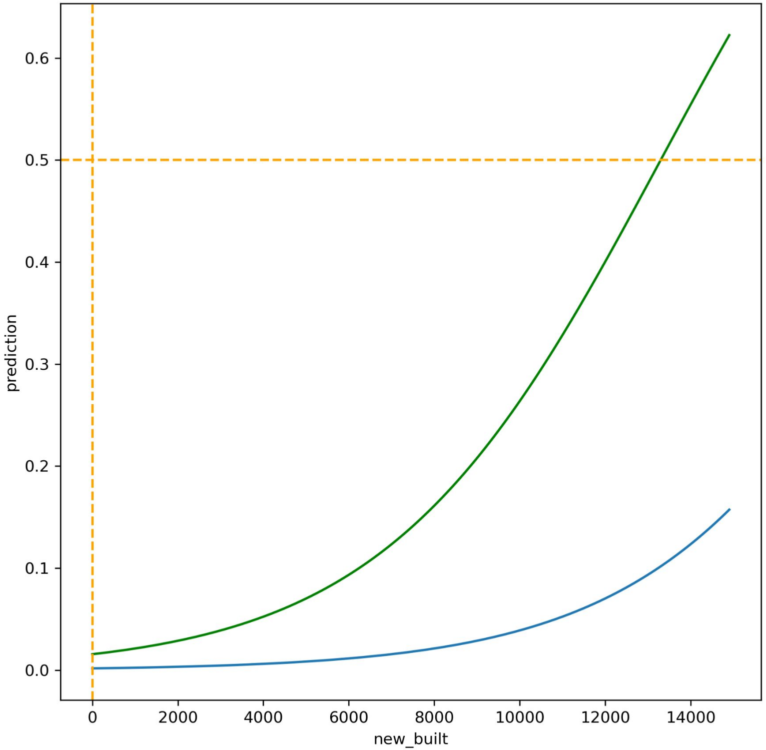


Model 1 Testing: Change in New Buildings

GENTRIFIED test variable

NON-GENTRIFIED test variable

Stronger predictions of a fresh zone based on # of new buildings per square mile are seen in the gentrified test variable.



Model 2: Fresh Stores in Brooklyn

Predicting the likelihood of a census tract being considered for a fresh store development within Brooklyn

Logit Regression Results

Dep. Variable:	fresh_store	**No. Observations:**	745
Model:	Logit	**Df Residuals:**	741
Method:	MLE	**Df Model:**	3
Date:	Tue, 02 May 2023	**Pseudo R-squ.:**	0.07832
Time:	16:50:15	**Log-Likelihood:**	-71.227
converged:	True	**LL-Null:**	-77.280
Covariance Type:	nonrobust	**LLR p-value:**	0.007031

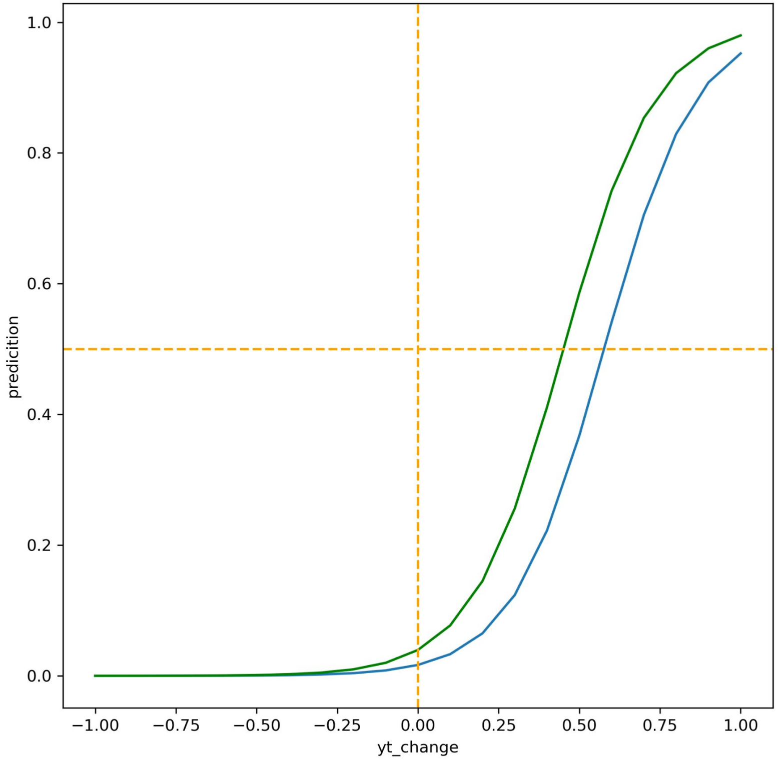
	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-4.1012	0.337	-12.183	0.000	-4.761	-3.441
inc_change	-5.72e-06	1.48e-05	-0.386	0.699	-3.48e-05	2.33e-05
yt_change	7.0766	2.308	3.067	0.002	2.554	11.600
new_built	0.0003	0.000	1.949	0.051	-1.81e-06	0.001

Model 2 Testing: Change in % of White Population

GENTRIFIED test variable

NON-GENTRIFIED test variable

Stronger predictions of a fresh zone based on white population changes are seen in the gentrified test variable.

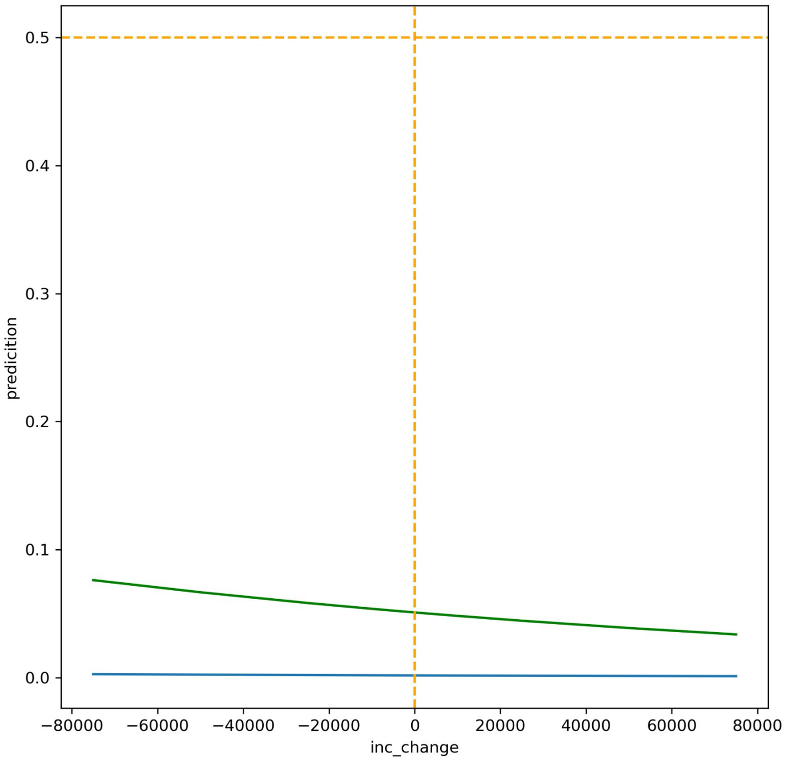


Model 2 Testing: Change in Household Income

GENTRIFIED test variable

NON-GENTRIFIED test variable

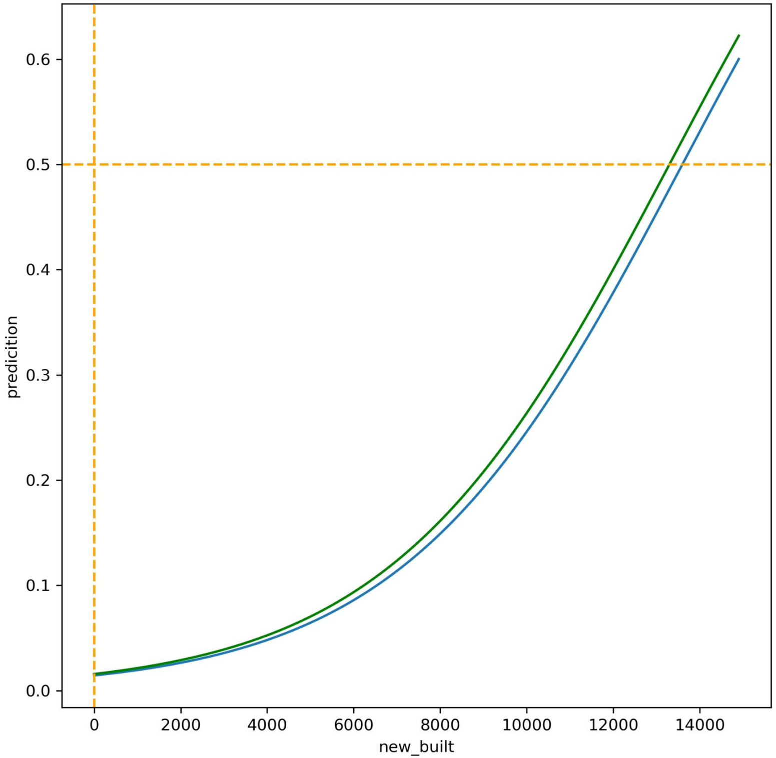
Stronger predictions of a fresh zone based on household income changes are seen in the gentrified test variable.



Model 2 Testing: Change in New Buildings

GENTRIFIED test variable

NON-GENTRIFIED test variable



Both variables increase their predictions by the similar rate number of new building per square mile increases.

Model 3: Fresh Stores in Bedford-Stuyvesant

Predicting the likelihood of a census tract being considered for a fresh store development within Bedford-Stuyvesant

Logit Regression Results

Dep. Variable:	fresh_zone	**No. Observations:**	66
Model:	Logit	**Df Residuals:**	62
Method:	MLE	**Df Model:**	3
Date:	Tue, 02 May 2023	**Pseudo R-squ.:**	0.03066
Time:	16:48:45	**Log-Likelihood:**	-41.936
converged:	True	**LL-Null:**	-43.262
Covariance Type:	nonrobust	**LLR p-value:**	0.4483

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	1.0648	0.491	2.167	0.030	0.102	2.028
inc_change	-2.996e-05	2.08e-05	-1.442	0.149	-7.07e-05	1.08e-05
yt_change	-0.7537	2.625	-0.287	0.774	-5.899	4.392
new_built	3.796e-07	0.000	0.001	0.999	-0.001	0.001

FAIL (see p values)

Ecological Fallacy

"inferences about the nature of specific individuals are based **solely upon aggregate statistics collected for the group to which those individuals belong**"

Source: wiki.GIS

Lessons Learned

Takeaways

- Logistic regression results can be difficult to interpret

    Cannot present in a linear fashion, results may be misleading

- As the spatial extent narrows, the significance of statistical outputs quickly diminish. City and Borough-wide extents are preferred moving forward.

Next Steps

- Address more indicators
    - different race breakdowns
    - other indicators quantifying poverty and hunger
- Conduct more web research before selecting test variables
    - chosen primarily on census numbers, lacks local context

Thank You!

Follow-Up Questions:

- What other neighborhood indicators should I consider?
- General notes / feedback on design?