



The City College
of New York

Characterizing Home Delivery to New York City Residents

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Direct-to-consumer goods and e-commerce

- E-Commerce in the U.S. in 2019
- \$1 in every \$10 of total retail spending
 - Almost \$600M
 - 14-15% increase Y.o.Y



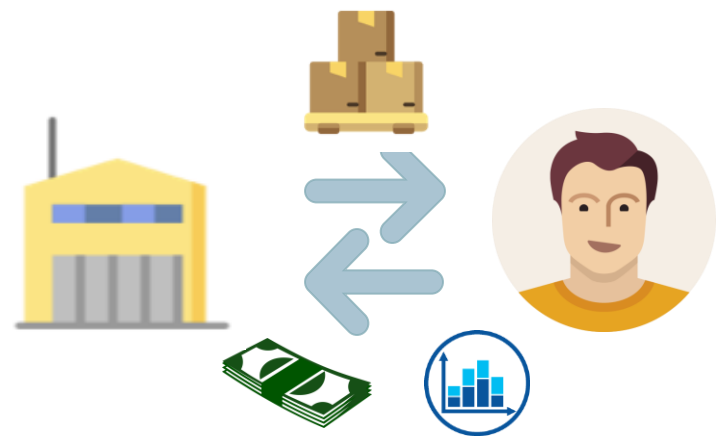
Source: Rothenberg, R. et al. (2018). IAB annual leadership meeting. <https://www.iab.com/wp-content/uploads/2018/02/The-Direct-Brand-Economy-Master-Deck-v13.pdf>

Direct-to-consumer goods and e-commerce

E-Commerce in the U.S. in 2019

- **\$1 in every \$10** of total retail spending
- Almost **\$600M**
- **14-15%** increase Y.o.Y.

Some of the channels are:



New York City: The city and the Network

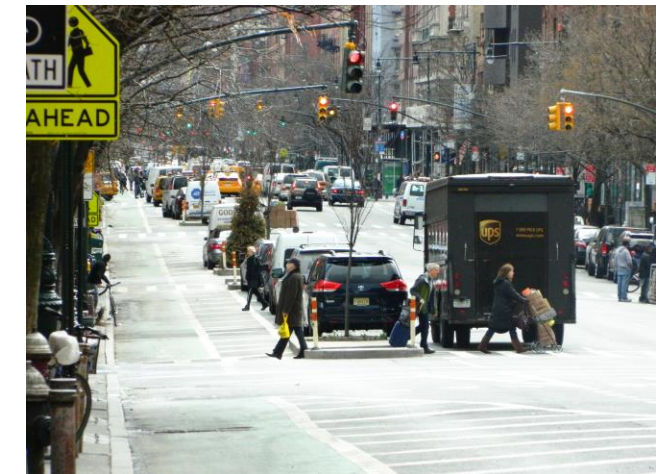
- Population
 - **8.5 million** in the Five Boroughs
 - 20+ million in metro area
- World city with a diverse economy
 - Tremendous **local demand**
 - Critical foreign trade gateways
- Holds a dense delivery infrastructure
 - **Truck routes** network
 - Plans to **improve** the delivery system
 - i.e. Parking in residential areas



New York City: The city and the Network

Several challenges are present and have been documented:

- Total cost of congestion in NYC is over **\$15 Billion** (Schrank, D., Eisele, B. And Lomax, T. (2019)).
- **Inadequate Freight Parking** (Jaller, M., Holguín-Veras, J. And Hodge, S. (2013)).
- **Outdated parking & loading dock requirements** (Morris, 2009).



Project Motivations and Goals

Project Motivation

- Market changes rising from e-commerce.
- Understanding new available data related to consumer preferences.
- Determining impacts in the existing Network.

Project Goal

- Characterizing the demand of home-delivery goods for NYC residents in 4 categories:
 - Groceries
 - Prepared Food
 - Personal Items
 - Other Packages



Inputs for the project

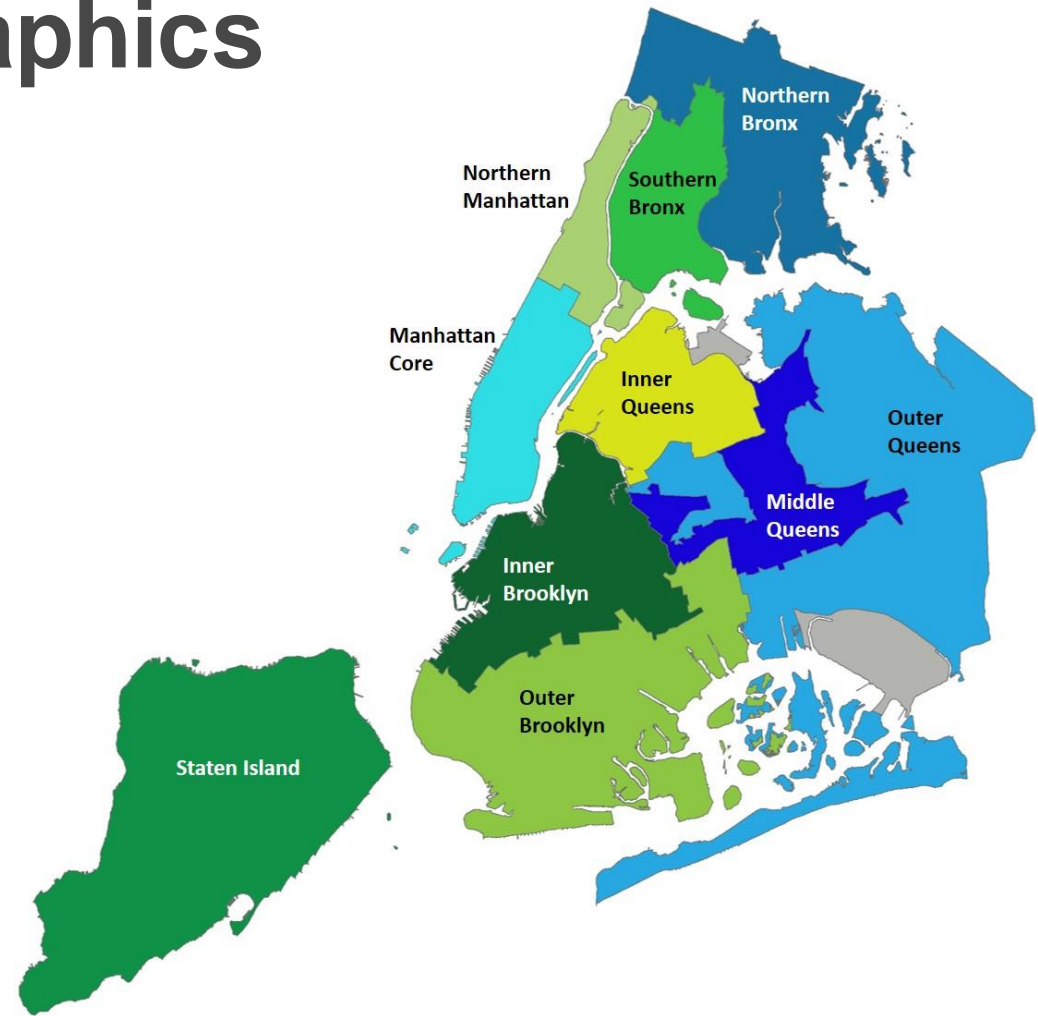
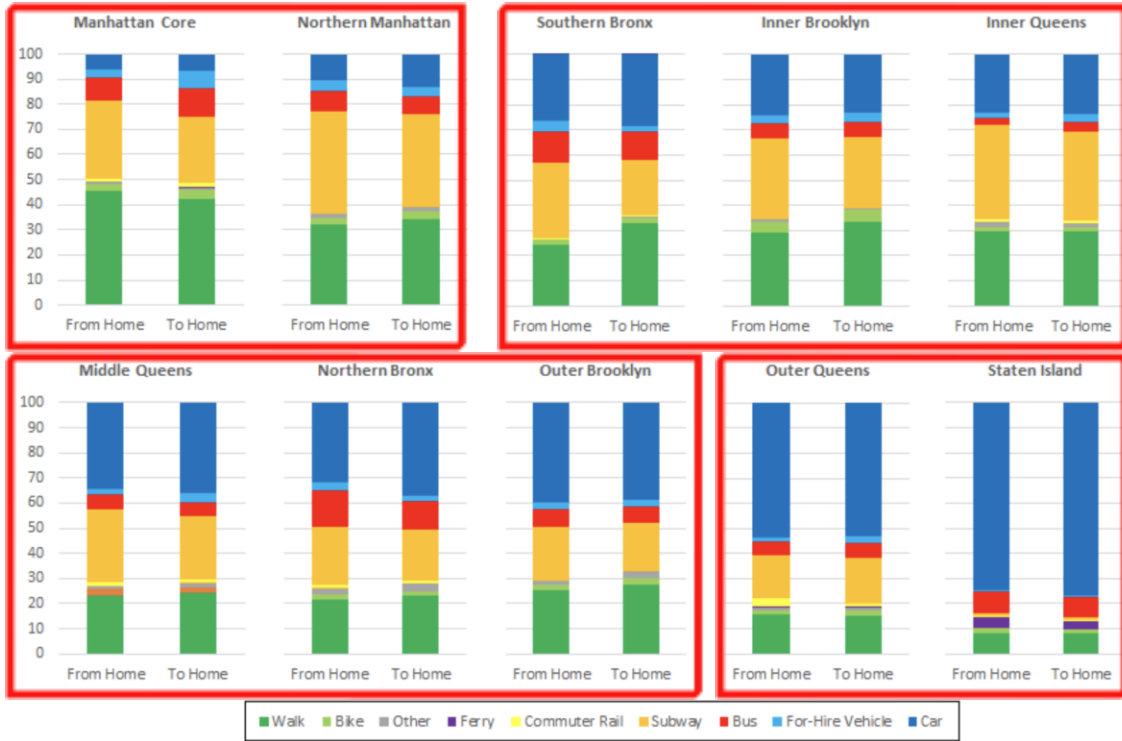
Data:

- City Mobility Survey (CMS)
- Main Survey
- Trip Diary



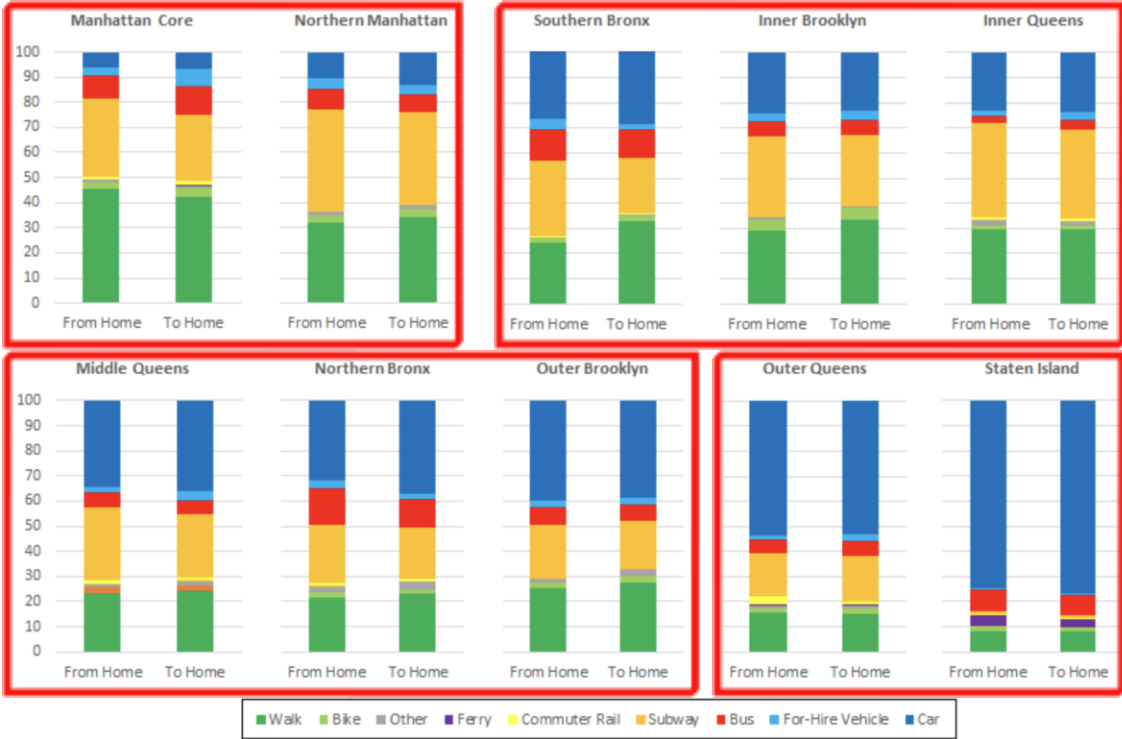
Segmentation and demographics

Transportation modes - HB Trips

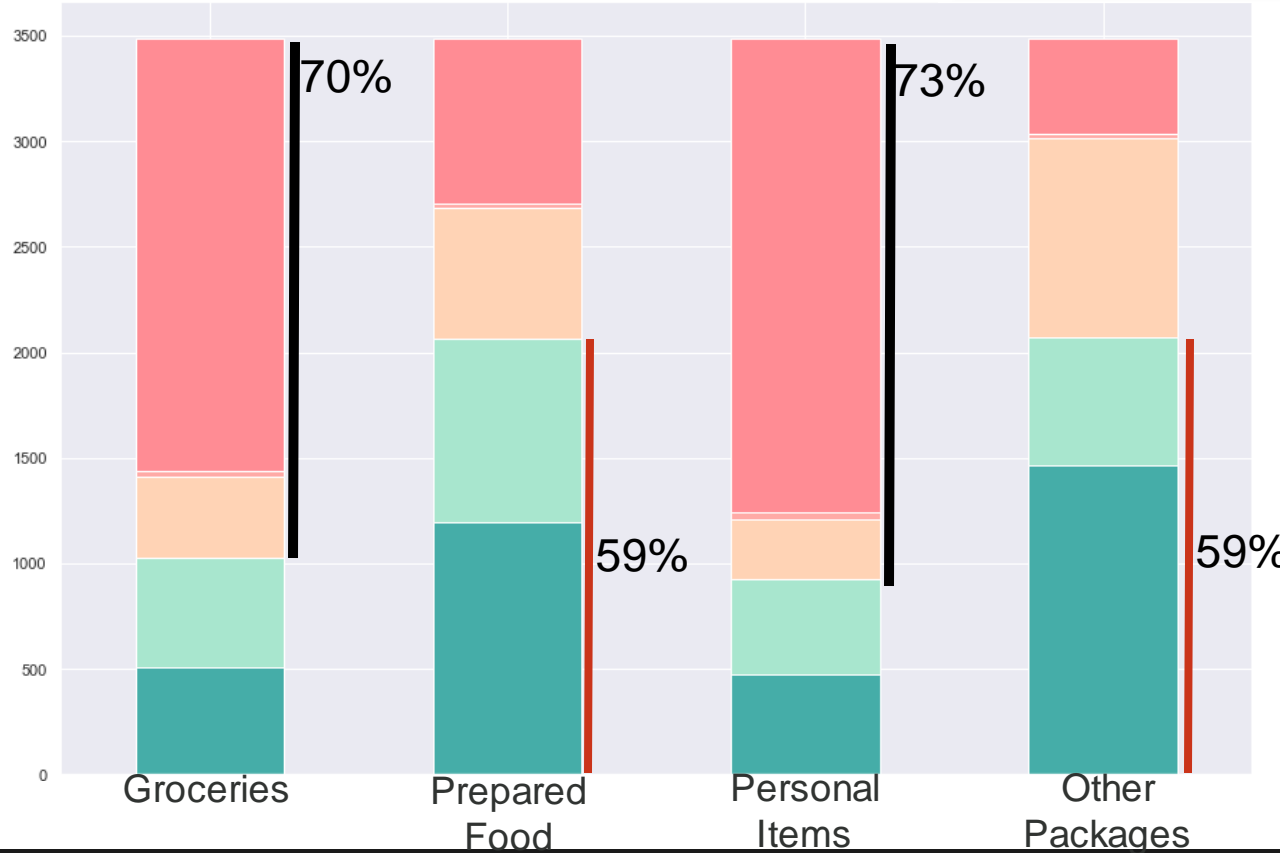
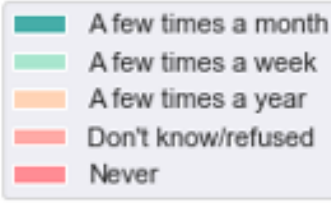


Segmentation and demographics

Transportation modes - HB Trips

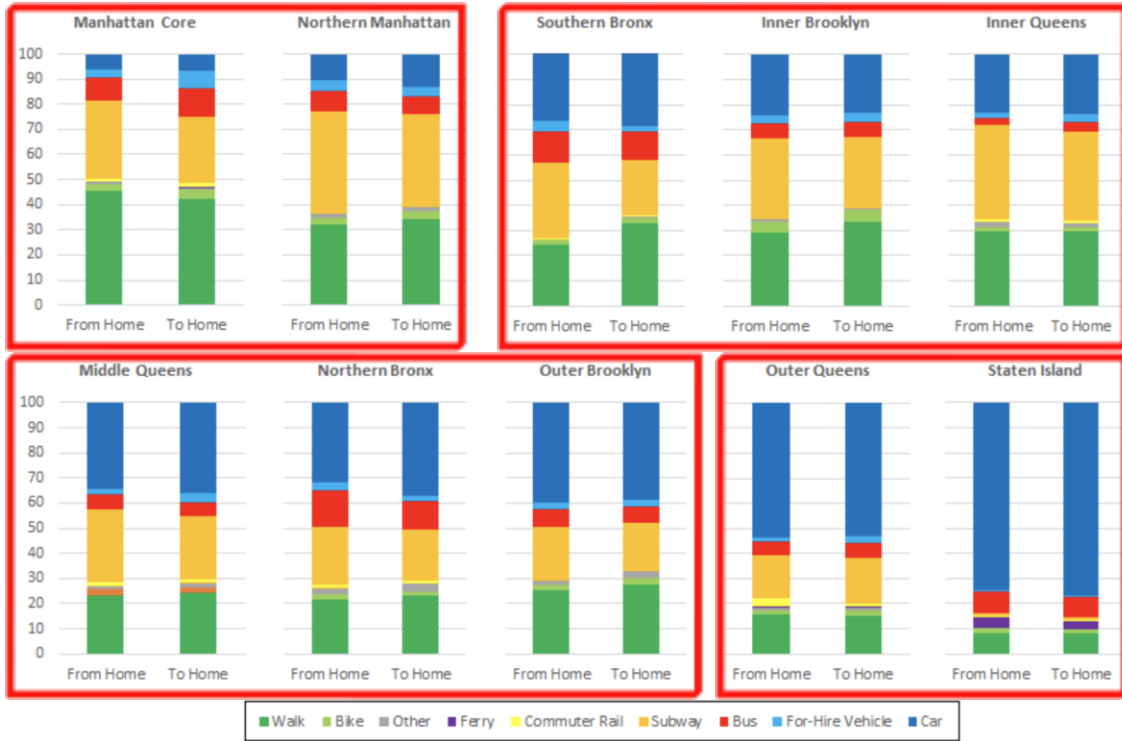


Delivery Variables Behavior

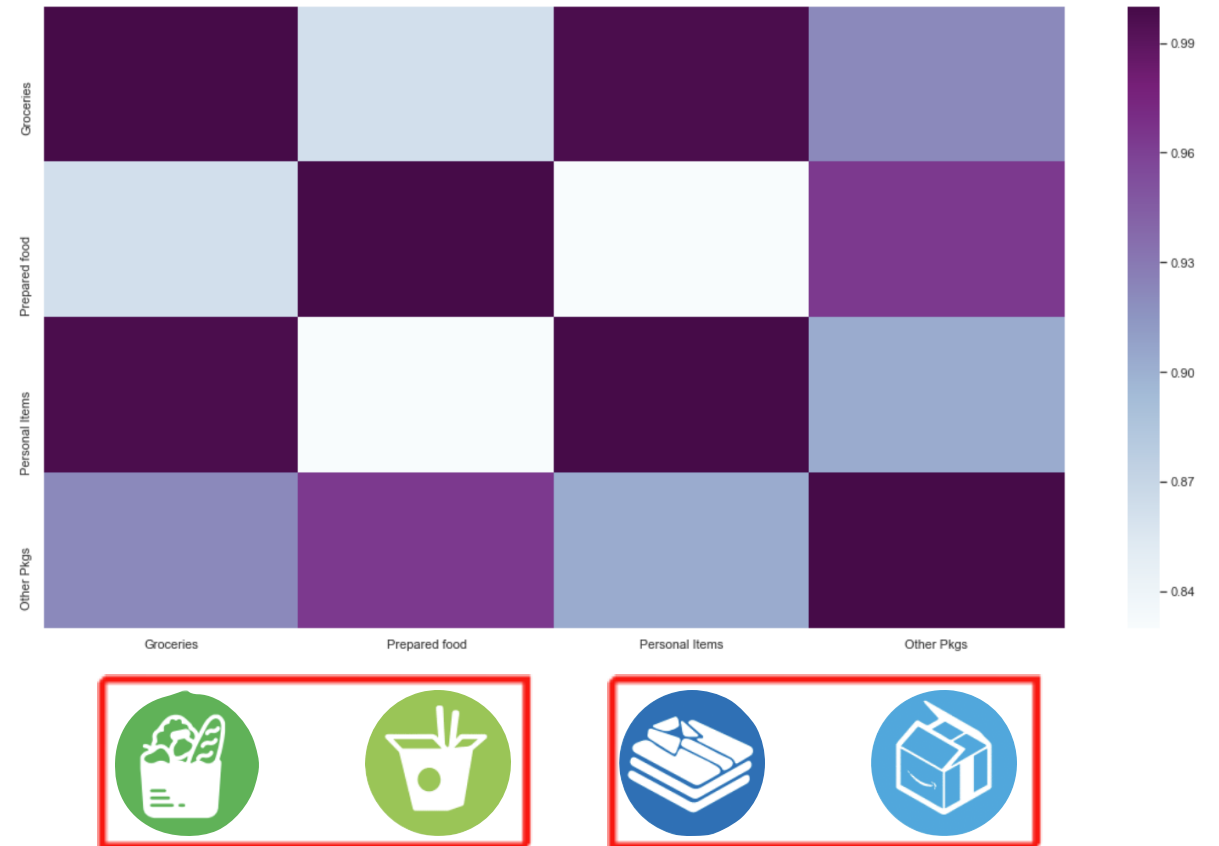


Segmentation and demographics

Transportation modes - HB Trips



Correlation - Delivery Variables

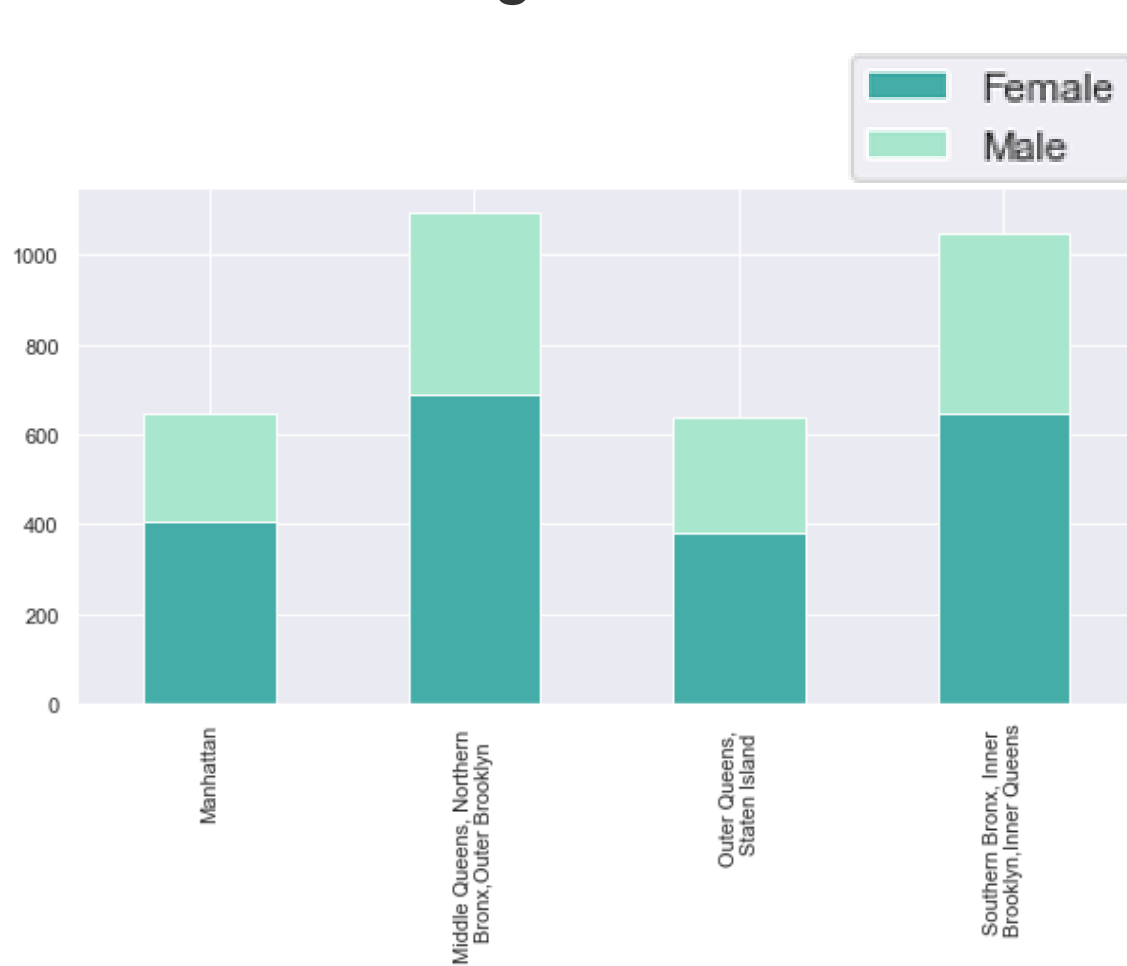


99%

97%

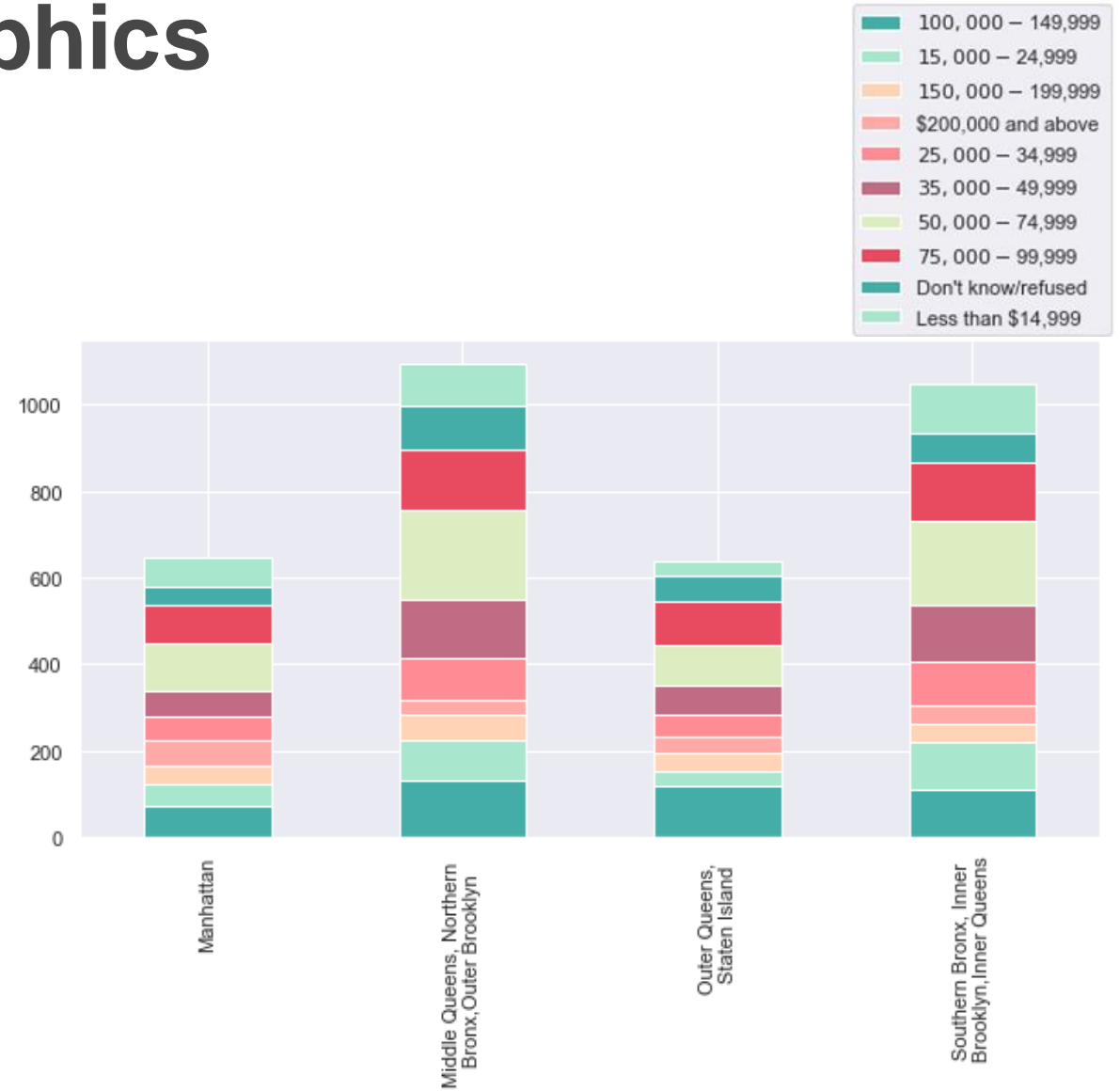
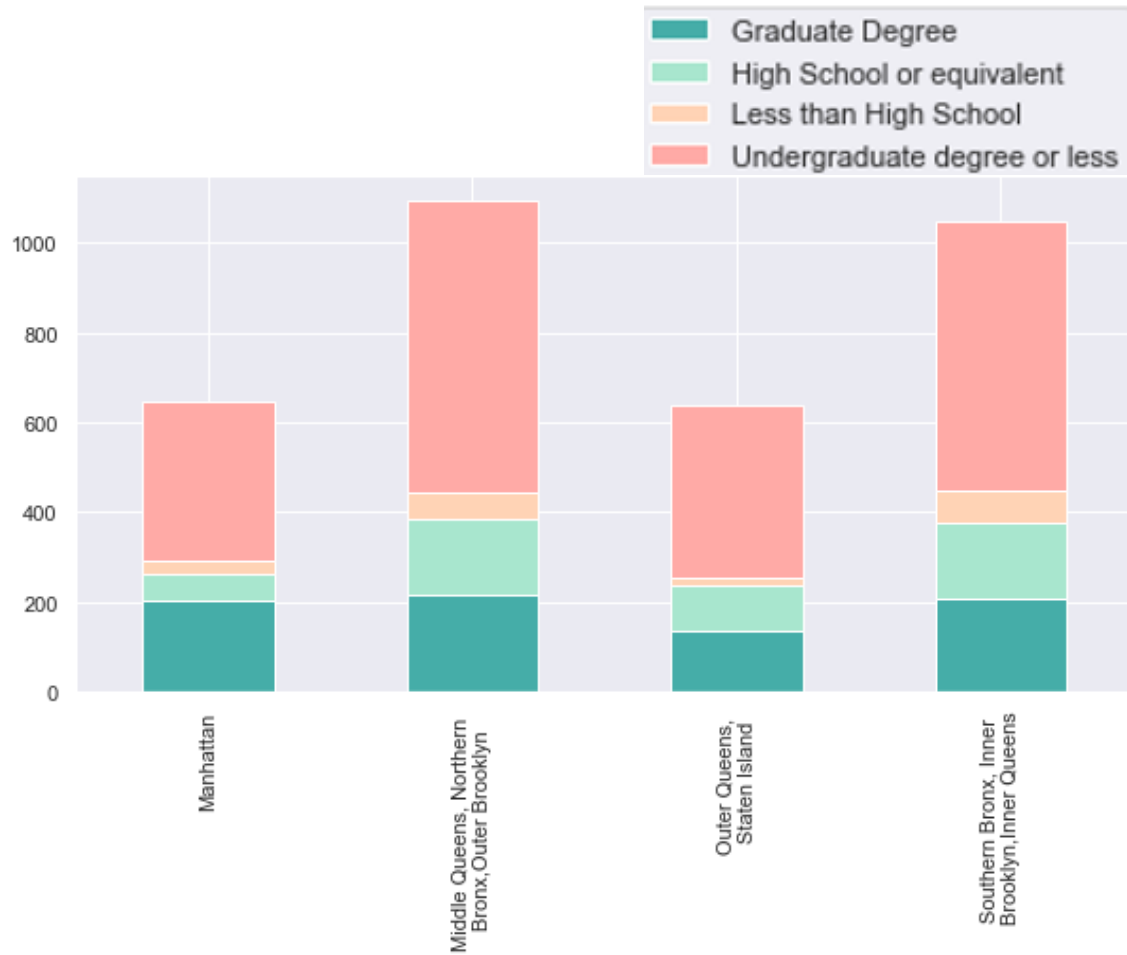
Segmentation and demographics

How do the neighborhoods look like?:



Segmentation and demographics

How do the neighborhoods look like?:



Segmentation and demographics

Groceries

	Number of observations
MANHATTAN	596
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	999
MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	1061
OUTER QUEENS, STATEN ISLAND	617
TOTAL	3273

Personal Items

	Number of observations
MANHATTAN	593
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	1001
MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	1057
OUTER QUEENS, STATEN ISLAND	615
TOTAL	3266

Segmentation and demographics

Prepared Food

	Number of observations
MANHATTAN	594
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	1005
MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	1063
OUTER QUEENS, STATEN ISLAND	619
TOTAL	3281

Other Packages

	Number of observations
MANHATTAN	596
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	1005
MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	1060
OUTER QUEENS, STATEN ISLAND	618
TOTAL	3279

Variables and model

Dependent Variables

Groceries

Prep. Food

Pers. Items

Other Pckgs

Independent variables

Gender

Car Access

Age

Bike Access

Race

Smartphone

Hispanic

Building type

Education

of Children

Income

Employment

Binomial Logit Model

Models Generated

“Once a Week” model

“Never” model

$$\log(\text{odds}(y_1)) = \beta_0 + \beta_{11} * G\text{NDR}_{male} + \dots + \beta_{14} * A\text{GE}_{55-64} + \dots$$

Variables - The base case



The definition of the base person for this model is:

- Female
- 25-34 years old
- White/Caucasian
- Not hispanic
- With an Undergraduate degree or less
- With an income of \$50K to \$75K
- Who has access to a car
- Who does not own a bike
- Who owns a smartphone
- She lives in a 10 to 40 apartment building
- She has no children
- She is employed (either full or part time)

Key Findings so far_Consumer Preference “Groceries”

+	-	Significance
✓	✗	0.1
✓✓	✗✗	0.05
✓✓✓	✗✗✗	0.01

“Once a week” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male			✓✓✓	✓✓✓
Age - 18 to 24			✓	
Age - 35 to 44			✗✗	
Age - 45 to 54	✓		✓✓✓	
Age - 55 to 64	✗✗		✓✓✓	
Age - Over 65			✓✓	
Race - Other		✓✓		
Education - High School	✓✓		✓✓✓	
Education - Less than High School			✓✓✓	
Income - Less than \$14,999		✓✓		
Income - \$15,000 to \$24,999				✓
Income - \$25,000 to \$34,999		✓✓✓	✓✓	
Income - \$150,000 to \$199,999	✓		✓✓	
Car Access - No access to car	✗✗✗	✓✓		
Building type - Over 50 Apts				✗✗
Building type - Other			✓✓✓	
Children - One			✓✓✓	
Children - Two	✓✓	✓✓✓	✓✓✓	
Children - Three	✓		✓✓	
Children - Four or more			✓✓✓	
Employment - Retired	✓			
Employment - Student		✓		
Intercept	✗✗✗	✗✗✗	✗✗✗	✗✗

“Never” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Age - 18 to 24			✓	
Age - 45 to 54		✓✓	✓✓✓	
Age - 55 to 64	✓✓		✓✓	
Age - Over 65			✓✓	
Race - African American	✓		✓✓	
Race - Other		✓	✓✓✓	
Hispanic - Yes			✓✓	
Education - High School			✓	
Education - Less than High School		✓	✗✗✗	
Income - \$15,000 to \$24,999	✓✓			
Income - \$25,000 to \$34,999			✓	
Income - \$100,000 to \$149,999		✓		
Income - \$200,000 and above		✗✗	✗✗✗	
Car Access - No access to car		✓✓		
Smartphone ownership - No	✓✓			
Children - One	✓			
Children - Two	✓			✓
Children - Three				✓
Children - Four or more		✗✗	✗✗✗	
Employment - Retired	✓✓✓			
Employment - Student		✓✓		
Employment - Unemployed		✓		

Key Findings so far_Consumer Preference “Personal items”

“Once a week” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male	✓✓		✓✓✓	
Age - 35 to 44			✓✓✓	
Age - 45 to 54	✓		✓✓	
Age - 55 to 64			✓✓	
Age - Over 65			✓✓	
Race - African American	✓✓			
Race - Other			✓	
Hispanic - Yes			✓✓	
Education - High School			✓	
Education - Less than High School		✓✓	✓✓✓	✓
Income - \$25,000 to \$34,999		✓✓✓	✓✓	
Income - \$150,000 to \$199,999			✓	
Car Access - No access to car		✓✓		
Bike ownership - Yes		✓✓		
Building type - One-family house	✓✓	✓	✓	
Building type - Other			✓	
Children - One		✓✓	✓✓	
Children - Two	✓✓	✓✓✓		
Children - Three		✓✓✓	✓	
Children - Four or more	✓✓✓			
Employment - Retired		✓		
Employment - Unemployed		✓		
Intercept	✓✓✓	✓✓✓	✓✓✓	

“Never” buyer

+	-	Significance
✓	✓	0.1
✓✓	✓✓	0.05
✓✓✓	✓✓✓	0.01

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male	✓	✓✓	✓✓✓	
Age - 35 to 44			✓✓✓	
Age - 45 to 54	✓✓	✓✓	✓✓✓	
Age - 55 to 64		✓	✓✓✓	
Age - Over 65	✓✓	✓	✓✓✓	
Race - Asian	✓✓		✓✓	
Race - African American	✓✓			✓✓
Race - Other			✓	✓
Hispanic - Yes			✓✓	
Education - High School	✓		✓	✓✓
Education - Less than High School		✓	✓✓	✓
Income - Less than \$14,999	✓✓			
Income - \$15,000 to \$24,999	✓			
Income - \$25,000 to \$34,999		✓✓	✓✓	
Income - \$75,000 to \$99,999	✓✓			
Income - \$100,000 to \$149,999			✓	
Income - \$150,000 to \$199,999	✓✓			
Income - \$200,000 and above	✓✓			
Income - Refused	✓		✓✓	
Car Access - No access to car			✓	
Building type - One-family house		✓✓	✓	
Building type - Other			✓	
Children - One	✓✓	✓		
Children - Two	✓	✓✓✓	✓	
Children - Three		✓✓		
Employment - Retired	✓✓	✓✓		
Employment - Student				✓✓
Employment - Unemployed		✓✓		
Intercept			✓✓✓	

Key Findings so far_Consumer Preference “Prepared Food”

“Once a week” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male	✓✓		✓	
Age - 35 to 44	✓			
Age - 45 to 54	✓✓	✓✓✓	✓✓	✓✓
Age - 55 to 64	✓✓	✓✓	✓✓✓	
Age - Over 65	✓✓✓		✓✓	
Race - Asian	✓	✓✓✓		
Education - High School		✓		
Education - Less than High School		✓✓		
Income - \$15,000 to \$24,999				✓✓✓
Income - \$25,000 to \$34,999			✓✓✓	
Income - \$100,000 to \$149,999	✓✓			
Income - \$150,000 to \$199,999			✓	
Income - \$200,000 and above	✓✓			
Car Access - No access to car		✓✓		
Bike ownership - Yes			✓	
Smartphone ownership - No			✓	
Building type - One-family house	✓✓	✓		
Building type - Over 50 Apts			✓✓	
Children - One			✓✓✓	
Children - Two				✓
Children - Three			✓	
Children - Four or more		✓	✓✓	
Employment - Retired		✓✓✓		
Employment - Stay-at-home parent			✓	
Employment - Unemployed	✓✓			✓✓
Intercept	✓✓	✓✓	✓✓✓	

“Never” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male		✓✓✓		
Age - 45 to 54	✓	✓	✓✓✓	
Age - 55 to 64		✓✓	✓✓✓	
Age - Over 65	✓	✓✓✓	✓✓✓	✓✓
Race - Asian		✓✓✓		✓✓
Race - African American		✓✓✓		
Race - Other		✓✓	✓	✓
Hispanic - Yes			✓	
Education - High School				✓✓
Income - Less than \$14,999		✓		✓✓
Income - \$75,000 to \$99,999	✓✓			
Income - \$100,000 to \$149,999	✓	✓		
Income - \$150,000 to \$199,999	✓✓			
Income - Refused		✓✓✓	✓✓	✓✓
Car Access - No access to car		✓✓	✓	
Smartphone ownership - No	✓✓✓	✓✓✓		✓
Children - Two		✓		
Children - Three		✓✓		
Employment - Retired		✓✓	✓	✓
Employment - Volunteer Work				✓✓
Intercept	✓✓✓	✓✓✓	✓✓✓	✓✓✓

+	-	Significance
✓	✓	0.1
✓✓	✓✓	0.05
✓✓✓	✓✓✓	0.01

Key Findings so far_Consumer Preference “Other Packages”

“Once a week” buyer

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Age - 45 to 54				✓
Age - 55 to 64			✓✓	
Age - Over 65				✓
Race - Asian		✓✓		
Race - Other	✓✓			
Hispanic - Yes	✓✓			
Education - Graduate Degree				✓
Education - High School	✓			
Income - Less than \$14,999	✓✓		✓✓	
Income - \$25,000 to \$34,999			✓✓	
Income - \$75,000 to \$99,999	✓		✓✓✓	
Income - \$100,000 to \$149,999	✓			
Income - \$150,000 to \$199,999			✓✓✓	
Income - \$200,000 and above	✓✓✓	✓✓✓	✓✓✓	✓✓
Car Access - No access to car		✓✓✓		
Bike ownership - Yes	✓✓			
Smartphone ownership - No				✓
Building type - One-family house	✓✓✓			
Building type - Other			✓✓	
Children - Two	✓✓✓	✓✓✓	✓✓✓	
Children - Three	✓			
Employment - Retired		✓✓		
Employment - Unemployed	✓✓			✓
Employment - Volunteer Work		✓		
Intercept	✓✓✓	✓✓✓	✓✓✓	

“Never” buyer

+	-	Significance
✓	✓	0.1
✓✓	✓✓	0.05
✓✓✓	✓✓✓	0.01

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male		✓✓		
Age - 35 to 44			✓✓	✓
Age - 45 to 54			✓✓	
Age - 55 to 64	✓		✓✓✓	
Age - Over 65	✓✓	✓✓	✓✓✓	
Race - Asian	✓✓			
Race - African American	✓	✓✓✓		
Race - Other		✓✓✓	✓✓✓	✓
Education - Graduate Degree	✓✓			
Education - High School			✓✓✓	
Education - Less than High School		✓✓✓		
Income - Less than \$14,999			✓✓	
Income - \$25,000 to \$34,999		✓		
Income - \$35,000 to \$49,999		✓		
Income - Refused		✓✓	✓✓✓	
Bike ownership - Yes		✓	✓✓✓	✓
Smartphone ownership - No	✓✓		✓✓	✓✓✓
Building type - Less than 10 Apts			✓✓✓	
Building type - Over 50 Apts			✓✓✓	
Employment - Retired		✓✓		
Intercept	✓✓✓	✓✓✓	✓✓✓	✓✓

Key Findings so far

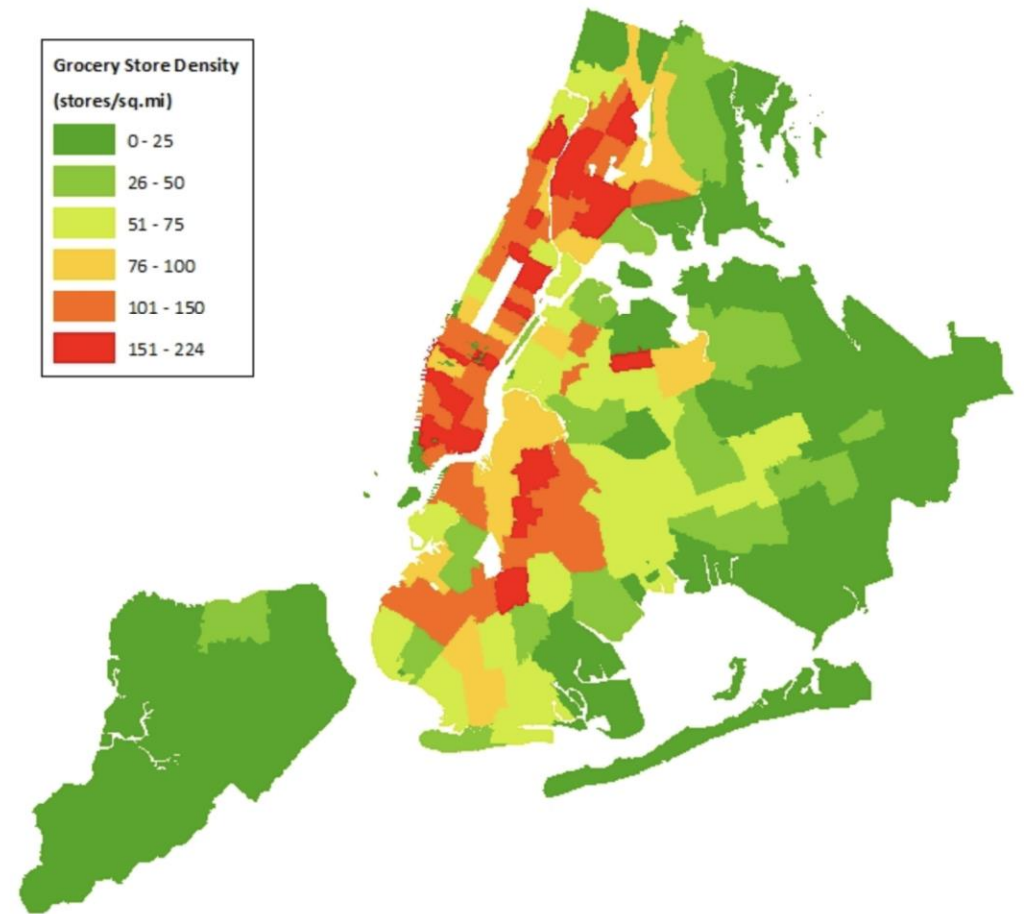
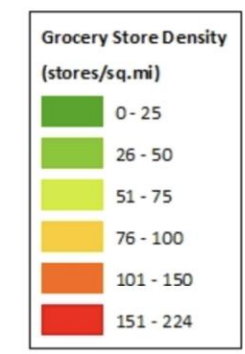
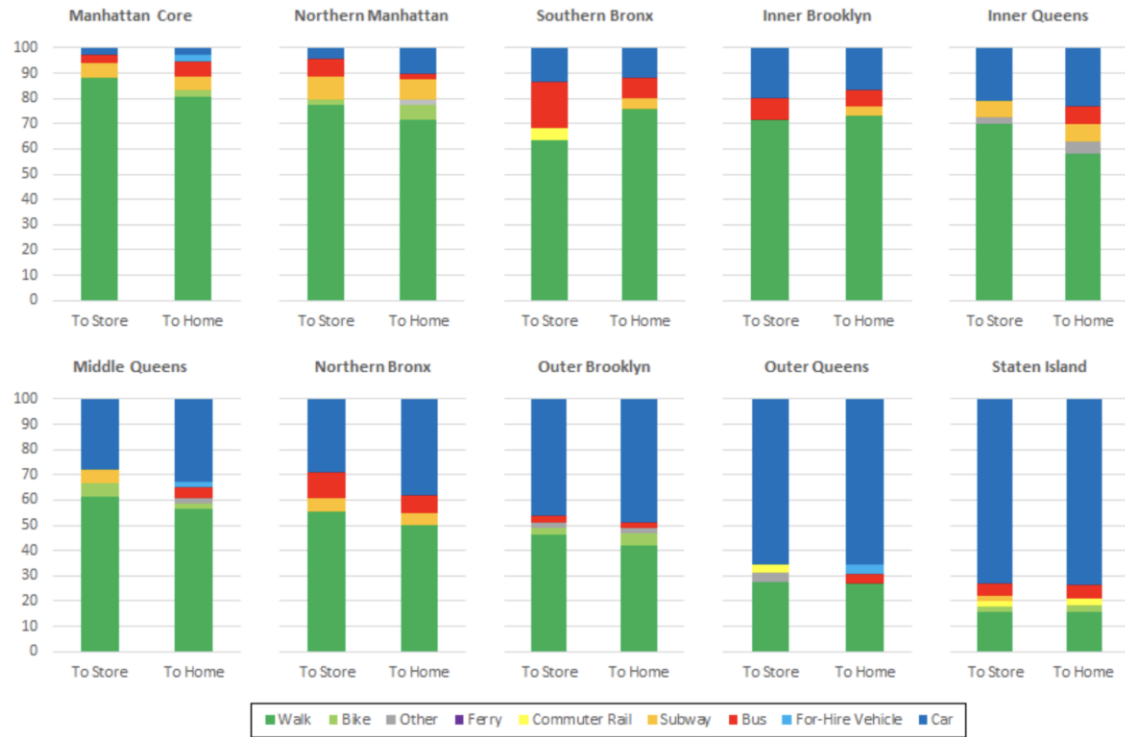
- Ultimately, we would like to create a model useful to **predict** how purchases of these four items will happen in the future.
- Online purchasing of these four items are **not solely explained by demographics**.
- Neighborhoods in NYC, **are and behave very differently**. In this research we found that localized models are necessary vs city wide models. This will allow to make better and more suitable plans for the city.

Next Steps and Future Research

- Second year data of the city mobility survey just came out. We want to use this data to **test** our model and make the correct adjustments.
- We want to analyze what other variables do impact people's choices to purchase these 4 goods. For this we will use land use data such as:
 - **NYC Open Data** (Restaurant Ratings)
 - **NY State Data** (Grocery Store and Laundromat Licenses)
 - **NYC Map Pluto Data**

Next Steps and Future Research

Land use and travel patterns _ Groceries



Thank you,
Questions?

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