

## The City College of New York

## **Characterizing Home Delivery** to New York City Residents

U.S. – International Freight Conference 2019 October 18, 2019 Carla Tejada
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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
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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





Data

## 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- Outdated parking & loading dock requirements (Morris, 2009).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 ecommerce.
- 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

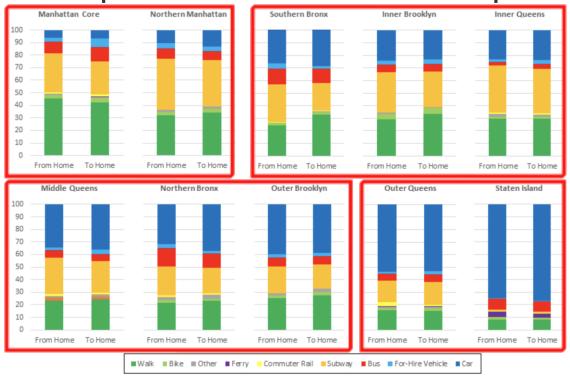
#### Data:

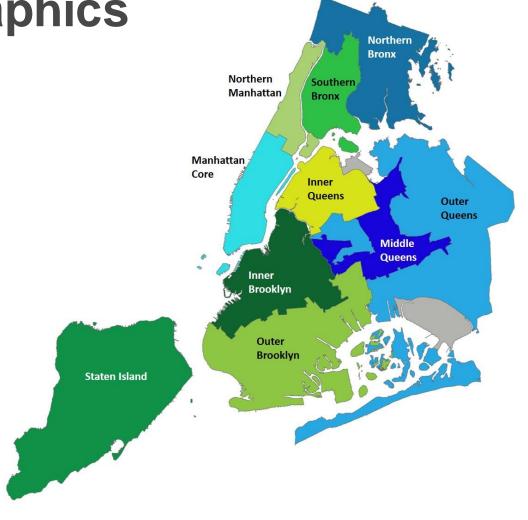
- City Mobility Survey (CMS)
  - Main Survey
  - Trip Diary





#### Transportation modes - HB Trips





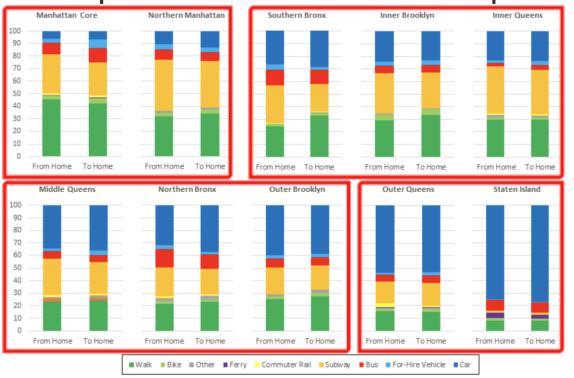
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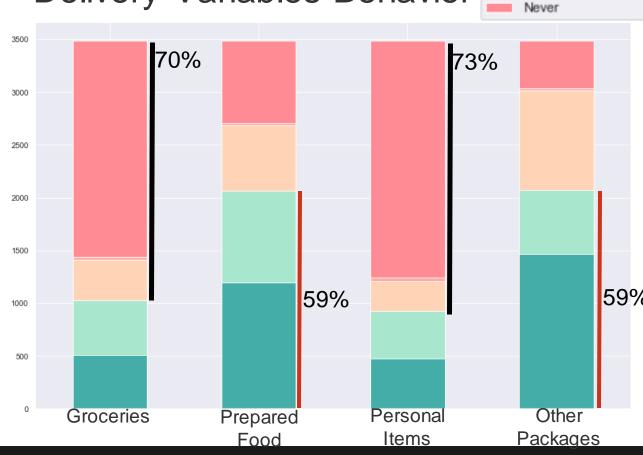


Data

#### Transportation modes - HB Trips



#### Delivery Variables Behavior



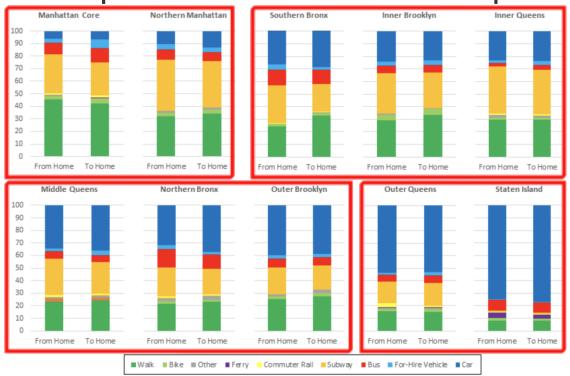
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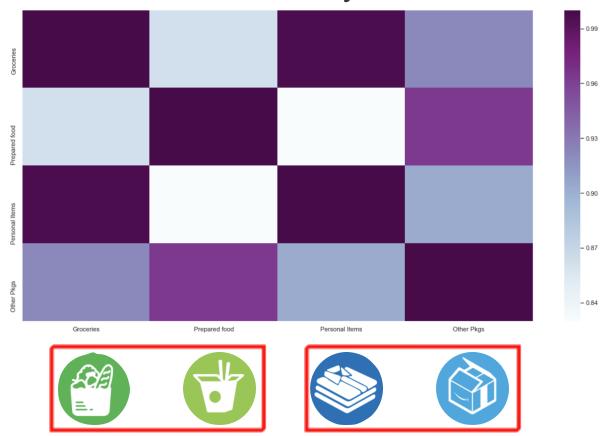
A few times a month A few times a week A few times a year

Don't know/refused

#### Transportation modes - HB Trips



#### Correlation - Delivery Variables



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99%

97%

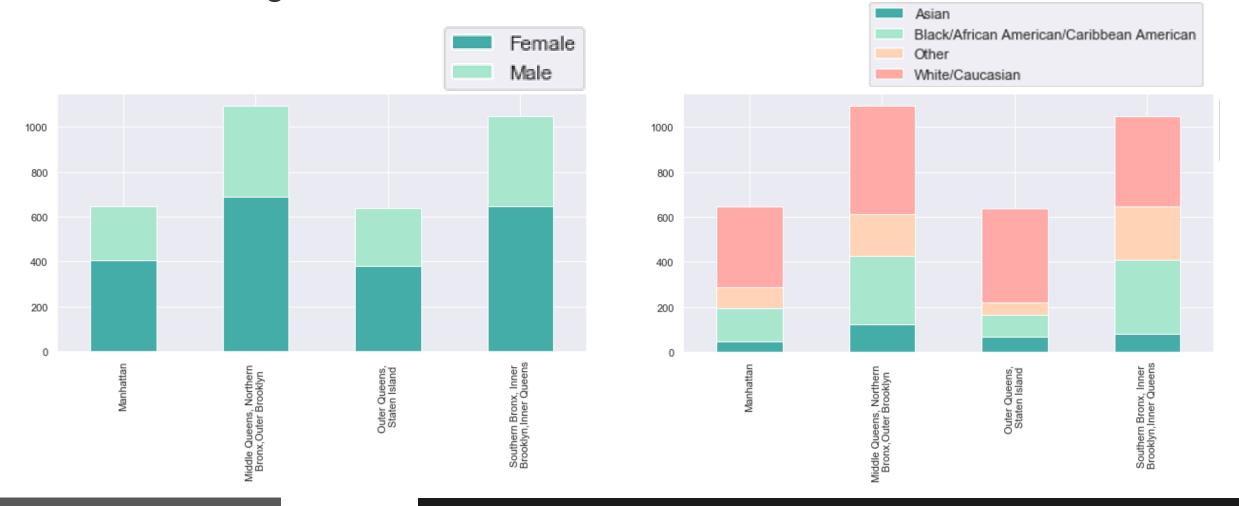
Motivations

Data

Initial Results

Future Research

How do the neighborhoods look like?:

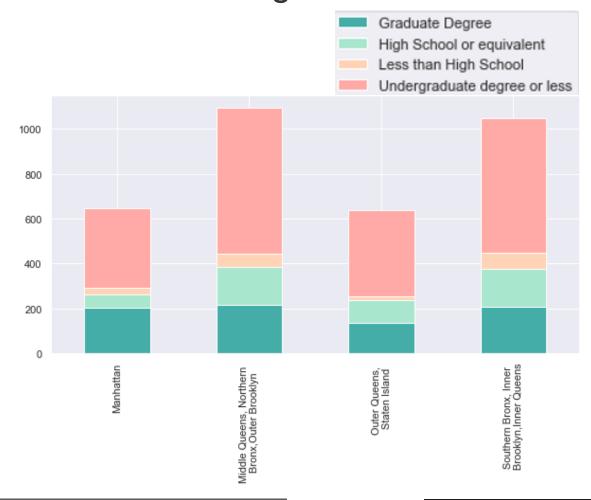


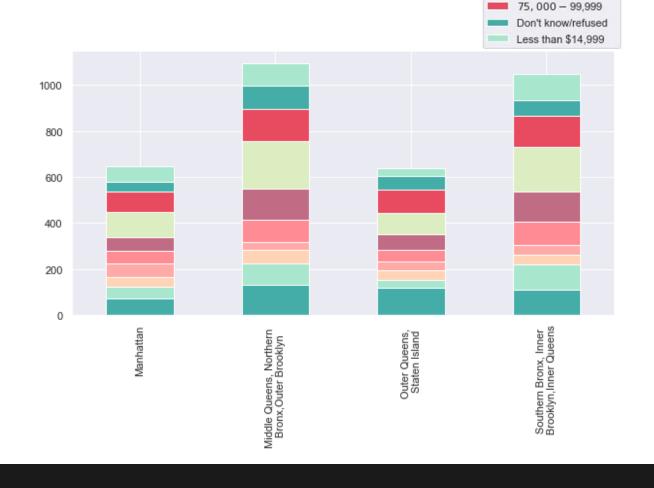
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Data

How do the neighborhoods look like?:





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Data

100, 000 - 149,999 15, 000 - 24,999 150, 000 - 199,999 \$200,000 and above

25, 000 - 34,999 35, 000 - 49,999

50,000 - 74,999

#### Groceries

	Number of observations
MANHATTAN	596
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	999
MIDDLE QUEENS, NORTHERN BRONX, OUTTER 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, OUTTER BROOKLYN	1057
OUTER QUEENS, STATEN ISLAND	615
TOTAL	3266



Prepared Food

	Number of observations
MANHATTAN	594
SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	1005
MIDDLE QUEENS, NORTHERN BRONX, OUTTER 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, OUTTER 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

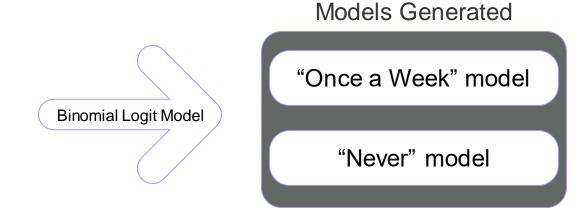
Age Bike Access

Race Smartphone

Hispanic Building type

Education # of Children

Income Employment



$$log(odds(y_1)) = \beta_0 + \beta_{11} * GNDR_{male} + \dots + \beta_{14} * AGE_{55-64} + \dots$$

#### 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 and 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"**

#### "Once a week" buver

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

#### "Never" buyer

+	-	Significance
<b>✓</b>	<b>✓</b>	0.1
<b>W</b>	<b>W</b>	0.05
<b>J</b> ///	<i>JU</i> /	0.01

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Age - 18 to 24			<b>✓</b>	
Age - 45 to 54		<b>W</b>	<b>///</b>	
Age - 55 to 64	4/		<b>W</b>	
Age - Over 65			<b>W</b>	
Race - African American	<b>✓</b>		<b>W</b>	
Race - Other		/	<b>W</b>	
Hispanic - Yes			<b>W</b>	
Education - High School			<b>✓</b>	
Education - Less than High School		<b>/</b>	<b>W</b>	
Income - \$15,000 to \$24,999	*			
Income - \$25,000 to \$34,999			<b>✓</b>	
Income - \$100,000 to \$149,999		<b>/</b>		
Income - \$200,000 and above		₩	<b>///</b>	
Car Access - No access to car		*		
Smartphone ownership - No	<b>W</b>			
Children - One	<b>✓</b>			
Children - Two	<b>✓</b>		<b>✓</b>	
Children - Three			<b>✓</b>	
Children - Four or more		<b>W</b>	<b>///</b>	
Employment - Retired	<b>///</b>			
Employment - Student		<b>W</b>		
Employment - Unemployed		<b>/</b>		

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## Key Findings so far\_Consumer Preference "Personal items"

"Once a week" buyer

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

"Never" buyer

+	-	Significance
<b>✓</b>	<b>✓</b>	0.1
<b>W</b>	<b>W</b>	0.05
<b>///</b>	<i>W</i>	0.01

Race - Other		MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MANHATTAN	VARIABLES
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 High School  Income - \$15,000 to \$24,999  Income - \$5,000 to \$34,999  Income - \$50,000 to \$199,999  Income - \$150,000 to \$199,999  Income - \$100,000 to \$199,999  Income - \$100,000 to \$199,999  Income - \$100,000 to \$199,999  Income - \$200,000 and above  Income - Refused  Car Access - No access to car  Building type - Other  Children - One  Children - Two  Children - Three  Employment - Retired		<i>///</i>	₩	<b>✓</b>	Gender - Male
Age - 55 to 64       //       ////////////////////////////////////		<b>///</b>			Age - 35 to 44
Age - Over 65       #       #         Race - Asian       #       #         Race - African American       #       #         Race - Other       #       #         Hispanic - Yes       #       #         Education - High School       #       #         Income - 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 - \$150,000 to \$149,999       #       #         Income - \$150,000 to \$199,999       #       #         Income - \$200,000 and above       #       #         Building type - One-family house       #       #         Building type - Other       #       #         Children - Three       #       #         Employment - Retired       #       #		<b>///</b>	₩	<b>W</b>	Age - 45 to 54
Race - Asian		<b>///</b>	✓		Age - 55 to 64
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 - \$150,000 to \$149,999  Income - \$150,000 to \$149,999  Income - \$150,000 to \$199,999  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 - Two  Children - Tree  Employment - Retired		<b>W</b>	✓	<b>4</b> /	Age - Over 65
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 \$149,999  Income - \$150,000 to \$199,999  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 - One-family house  Income - Two  Children - Two  Children - Three  Employment - Retired		₩		<b>W</b>	Race - Asian
Hispanic - Yes  Education - High School  Z  Education - Less than High School  Income - Less than High School  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 \$149,999  Income - \$150,000 to \$199,999  Income - \$160,000 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  W  Income - Retired  Income - Retired  Income - \$100,000 to \$199,999  Income - \$150,000 to \$199,999  Income - \$200,000 and above  Income - \$150,000 to \$199,999  Income - \$150,000 to \$149,999  Income - \$150,000 to \$1	<b>W</b>			<b>W</b>	Race - African American
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	✓	<b>✓</b>			Race - Other
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 \$149,999 Income - \$150,000 to \$199,999 Income - \$200,000 and above Income - Refused Income - Supplied - Refused Income - Refused Income - Refused Income - Refused Income - Supplied - Refused Income - Refused Income - Supplied - Refused Income - Supplied - Refused Income - Refused Income - Refused Income - Refused Income - Supplied - Refused Income - Re		₩			Hispanic - Yes
Income - Less than \$14,999	<b>W</b>	<b>✓</b>		<b>✓</b>	Education - High School
Income - \$15,000 to \$24,999	<b>✓</b>	₩	✓		Education - Less than High School
Income - \$25,000 to \$34,999				<b>W</b>	Income - Less than \$14,999
Income - \$75,000 to \$99,999				<b>✓</b>	Income - \$15,000 to \$24,999
Income - \$100,000 to \$149,999 Income - \$150,000 to \$199,999 Income - \$200,000 and above Income - Refused V Car Access - No access to car Building type - One-family house Building type - Other Children - One V Children - Two V Children - Three Employment - Retired V Income - \$150,000 to \$149,999 V Income - \$150,000 to \$199,999 V V V V Car Access - No access to car V V V V Car Access - No access to car V V V V Car Access - No access to car V V V Car Access - No access to car V V V Car Access - No access to car V V V Car Access - No access to car V V V Car Access - No access to car V V Car Access - No access to car V V Car Access - No access to car V Car Access - N		₩	₩		Income - \$25,000 to \$34,999
Income - \$150,000 to \$199,999				<b>W</b>	Income - \$75,000 to \$99,999
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		✓			Income - \$100,000 to \$149,999
Income - Refused  Car Access - No access to car  Building type - One-family house  Building type - Other  Children - One  Children - Two  Children - Three  Employment - Retired				<b>W</b>	Income - \$150,000 to \$199,999
Car Access - No access to car  Building type - One-family house  Building type - Other  Children - One  Children - Two  Children - Three  Employment - Retired				W	Income - \$200,000 and above
Building type - One-family house Building type - Other Children - One Children - Two Children - Three Employment - Retired  W  V  V  W  V  U  U  U  U  U  U  U  U  U  U  U  U		₩		<b>✓</b>	Income - Refused
Building type - Other  Children - One  Children - Two  Children - Three  Employment - Retired  M  Children - W  M  M  M  M  M  M  M  M  M  M  M  M  M		✓			Car Access - No access to car
Children - One		<b>✓</b>	<b>W</b>		Building type - One-family house
Children - Two  Children - Three  Employment - Retired  W  W  W		<b>✓</b>			Building type - Other
Children - Three  Employment - Retired  W			✓	<b>W</b>	Children - One
Employment - Retired		<b>✓</b>	<b>///</b>	<b>✓</b>	Children - Two
			₩		Children - Three
Employment - Student			₩	W	Employment - Retired
	<b>W</b>				Employment - Student
Employment - Unemployed			₩		Employment - Unemployed
Intercept		<b>///</b>			Intercept

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## Key Findings so far\_Consumer Preference "Prepared Food"

"Once a week" buver

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

"Never" buyer

+	-	Significance
<b>/</b>	<b>✓</b>	0.1
W	<b>W</b>	0.05
<b>///</b>	<i>JU</i> /	0.01

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male		<b>///</b>		
Age - 45 to 54	<b>✓</b>	<b>✓</b>	<b>44</b> /	
Age - 55 to 64		<b>4</b> /	<b>44</b> /	
Age - Over 65	<b>✓</b>	<b>///</b>	<b>///</b>	<b>W</b>
Race - Asian		<b>///</b>		<b>W</b>
Race - African American		<b>///</b>		
Race - Other		<b>4</b> /	<b>✓</b>	<b>✓</b>
Hispanic - Yes			✓	
Education - High School				<b>W</b>
Income - Less than \$14,999		✓		<b>W</b>
Income - \$75,000 to \$99,999	<b>W</b>			
Income - \$100,000 to \$149,999	<b>✓</b>	<b>✓</b>		
Income - \$150,000 to \$199,999	<b>W</b>			
Income - Refused		<b>///</b>	<b>W</b>	<b>W</b>
Car Access - No access to car		<b>4</b> /	✓	
Smartphone ownership - No	<b>JU</b>	<b>///</b>		<b>✓</b>
Children - Two		<b>✓</b>		
Children - Three		<b>4</b> /		
Employment - Retired		<b>W</b>	✓	✓
Employment - Volunteer Work				<b>W</b>
Intercept	<b>///</b>	<b>///</b>	<b>///</b>	<b>///</b>

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**Motivations** 

#### Key Findings so far\_Consumer Preference "Other Packages"

"Once a week" buver

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

"Never" buyer

	+	-	Significance	
,	/	<b>✓</b>	0.1	
•	<b>/</b>	<b>W</b>	0.05	
×	W	<i>JU</i> /	0.01	

VARIABLES	MANHATTAN	SOUTHERN BRONX, INNER BROOKLYN, INNER QUEENS	MIDDLE QUEENS, NORTHERN BRONX, OUTTER BROOKLYN	OUTER QUEENS STATEN ISLAND
Gender - Male		<b>W</b>		
Age - 35 to 44			<b>4</b> /	✓
Age - 45 to 54			<b>4</b> /	
Age - 55 to 64	✓		<i>\\\</i>	
Age - Over 65	<b>W</b>	<b>W</b>	<i>///</i>	
Race - Asian	<b>W</b>			
Race - African American	✓	<b>///</b>		
Race - Other		<b>44</b> /	<i>///</i>	<b>✓</b>
Education - Graduate Degree	<b>W</b>			
Education - High School			<i>-</i> ///	
Education - Less than High School		<b>44</b> /		
Income - Less than \$14,999			<b>4</b> /	
Income - \$25,000 to \$34,999		✓		
Income - \$35,000 to \$49,999		✓		
Income - Refused		<b>W</b>	<i>-</i> ///	
Bike ownership - Yes		✓	<i>JU</i>	<b>✓</b>
Smartphone ownership - No	<b>W</b>		<b>4</b> /	<b>///</b>
Building type - Less than 10 Apts			<i>JU</i>	
Building type - Over 50 Apts			<i>JU</i>	
Employment - Retired		<b>W</b>		
Intercept	<b>///</b>	<b>///</b>	<b>///</b>	<b>W</b>

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## **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**

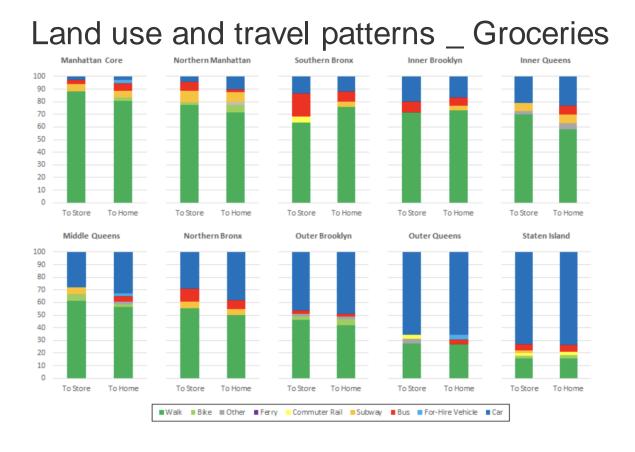
- Second year data of the city mobility survey just came out. We want to use this data to **test** our model and make the correct adjustments.
- We want to analyze what other variables do impact people's choices to purchase these 4 goods. For this we will use land use data such as:
  - NYC Open Data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

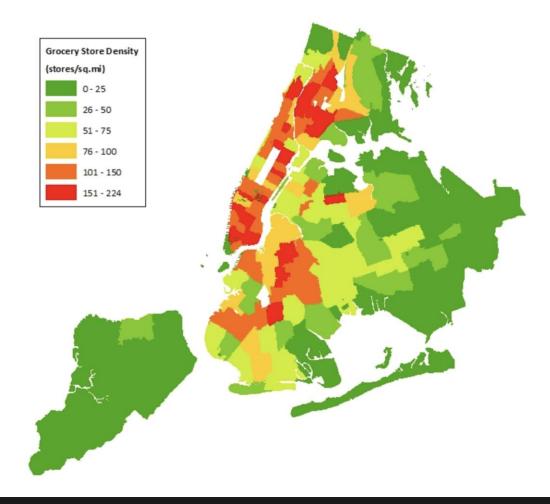
Introduction

NYC Map Pluto Data



## **Next Steps and Future Research**





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# Thank you, Questions?

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