Guaranteed Parking – Guaranteed Driving:

Comparing Jackson Heights, Queens and Park Slope, Brooklyn shows that a guaranteed parking spot at home leads to more driving to work.

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Does a guaranteed private parking spot induce more driving?

Introduction

Suburbanizing the City[1] showed that New York City zoning regulations encourage car ownership, and increase overall driving by New York City residents. In this report we compare the neighborhoods of Jackson Heights, Queens with Park Slope in Brooklyn. We show that the presence of guaranteed, off-street, parking at home results in a larger share of car owners choosing to drive to work. New York City zoning regulations require new residential buildings to include off-street parking for some or all residents thus contributing to increases in driving to work. **The findings in this report strongly suggest that New York City zoning regulations promote driving to work, even when a viable transit option exists.**

Indicators such as income, car ownership, density, government employment, and the difference between drive and transit times to the central business district (CBD) predict a higher share of auto commuting by Park Slope residents. **Yet Jackson Heights residents are 45% more likely to drive to work in the Manhattan CBD and 28% more likely to commute by car in general.** Notably, Jackson Heights sends 23% fewer commuters to the Manhattan CBD than Park Slope, but 13% more auto commuters. In this report we show why Jackson Heights residents are more likely to drive.

The report is organized into the following sections: *Demographics, Car Ownership, Government Employment* and *Commute Behavior* in which we use census data to compare the two neighborhoods; *Transit Access* and *CBD Travel Times* in which we look at differences in access to the Manhattan CBD; Parking in which we document the differences in off-street parking for the two neighborhoods; and finally, we present our conclusion explaining the difference in likelihood of driving to work.

We show that there is significantly more off-street parking in Jackson Heights and that this difference likely accounts for a higher share of car owners driving to work from there. We also find evidence that contradicts the premise that middle class families will not move to New York City if accessory parking is not required in new housing. Both Jackson Heights and Park Slope are considered solidly middle class yet, because most buildings pre-date City parking requirements, they contain far less parking than required in new buildings by the City Planning commission. In 2007, Park Slope was named one of America's "Ten Great Neighborhoods" by the American Planning Association[2] despite an **off-street parking/dwelling unit ratio eight times lower** than that required for new housing there by City Planning. Similarly, Jackson Heights attracts many middle class families with an **off-street parking/dwelling unit ratio four and a half times lower** than that required by the zoning code.

The analysis presented here is compelling but also specific to the two neighborhoods studied. It would have to be supplemented with additional fieldwork and analysis before drawing citywide conclusions.

[1] Weinberger et al. 2008. Suburbanizing the City, New York, NY http://www.transalt.org/files/newsroom/reports/suburbanizing_the_city.pdf (accessed October 1, 2008)

[2] American Planning Association. 2007. Great Places in America: Neighborhoods http://www.planning.org/greatplaces/neighborhoods/2007/parkslope.htm (accessed October 1, 2008)

Study Area

We selected Jackson Heights, which was identified by the City as a high auto-use "hot spot"[3], and Park Slope a roughly comparable neighborhood with respect to auto ownership, number of households and employed residents, and access to the Manhattan central business district (CBD). The study area boundaries are illustrated below in Figure 1.

Demographics, Car Ownership, Government Employment and Commute Behavior

Jackson Heights' population is larger than Park Slope's, but the two neighborhoods have almost the same number of households and employed residents. Park Slope households are more likely to own at least one car, 42% of them do compared with 39% in Jackson Heights. But Jackson Heights car owners are more likely to own multiple vehicles, 13% of them do as opposed to only 11% in Park Slope. These and other differences are shown in Table 1.

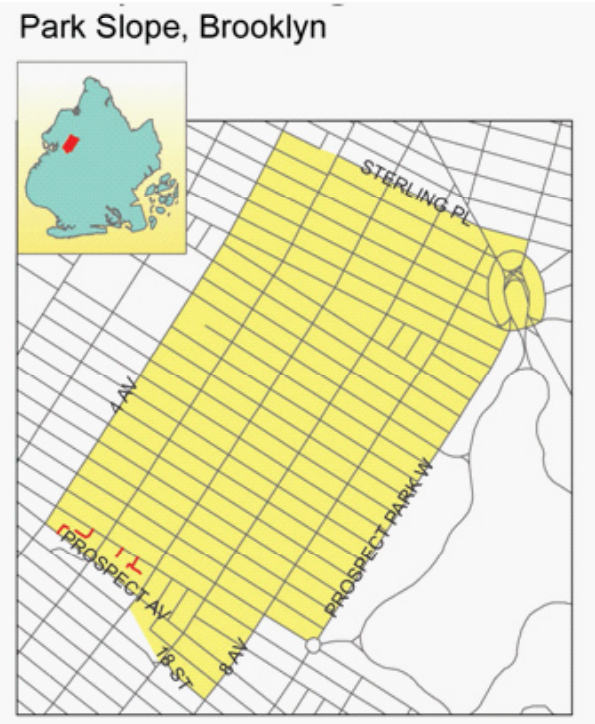
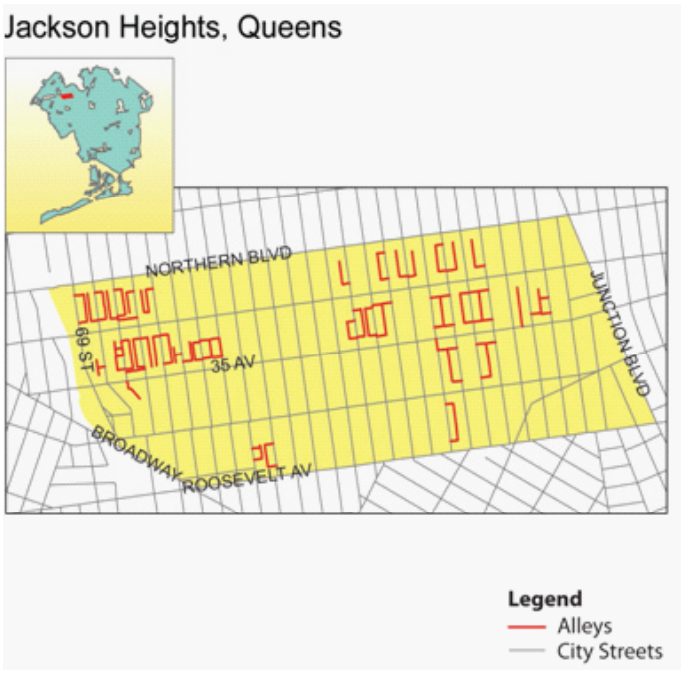


Figure 1. Study Area Boundaries

As the table shows, Jackson Heights residents are 28% more likely to commute by auto (23% versus 18%) and Jackson Heights accounts for more auto commuters to the CBD than Park Slope, despite having a smaller number of residents who work in the CBD. Jackson Heights sends 23% fewer workers to the Manhattan CBD but 13% more drivers. Thus, **Jackson Heights residents are 45% more likely to drive to work in the CBD than Park Slope residents**. The percentage of Jackson Heights CBD commuters who drive is relatively low, compared with Queens as a whole, but significantly higher than Park Slope.

The primary predictors of mode choice are income, auto ownership, density[4] and travel time differences between competing modes. Higher income and higher levels of auto ownership are associated with higher auto use while higher density is typically associated with better transit alternatives and therefore lower auto use. These relationships suggest that Park Slope, with higher income, higher rates of auto ownership and lower density would have a greater share of auto commuters. Travel time differences are discussed in the next section.

In New York City another critical factor is government employment. A 2006 study[5] showed that government workers,



[3] The Jackson Heights neighborhood boundary identified as a driving hotspot included additional area to the north. For this analysis we restrict the area to the census tracts bounded by the Brooklyn-Queens Expressway, Northern Boulevard, Junction Boulevard, and Roosevelt Avenue.

[4] Density and auto ownership, though, are also highly correlated with each other.

[5] Schaller, Bruce. 2006. *Necessity or Choice? Why People Drive in Manhattan*. New York, NY http://www.transalt.org/files/newsroom/reports/schaller_Feb2006.pdf (accessed October 1, 2008)

Table 1. Neighborhood Characteristics

	Jackson Heights[1]	Park Slope[1]
Demographics		
Population	71,186	53,078
Occupied housing units	24,900	24,360
Average household size	2.9	2.2
Area (square miles)	0.73	0.93
Population per square mile	97,515	57,073
Household per square mile	34,110	26,194
Median household income[2]	$39,566	$60,711
Home ownership (% of households)	27%	34%
Vehicle ownership		
Vehicles owned	11,625	11,875
Vehicles per employed resident	0.37	0.38
Households with at least one vehicle	39%	42%
Households with multiple vehicles	13%	11%
Commuting behavior		
Employed residents	31,190	31,619
Drive or carpool to work	7,029	5,300
Percent auto share	23%	18%
Residents employed in CBD	12,824	16,481
Drive or carpool to CBD	1,004	885
Percent auto share to CBD	7.8%	5.4%

Source: US Census Bureau, Census 2000. Tables P1, P51 H6, H7, H44

[1] Jackson Heights is defined as the census tracts bounded by the Brooklyn-Queens Expressway, Northern Boulevard, Junction Boulevard, and Roosevelt Avenue. Park Slope is defined as the whole census tracts bounded by Fourth Avenue, Sterling Place, Prospect Park (or 8th Avenue south of 16th Street), and the Prospect Expressway. While Flatbush Avenue is the more traditional boundary of Park Slope, census tracts north of Sterling cross Flatbush into Prospect Heights.

[2] Median household income is estimated by using the weighted average of the median incomes of the census tracts in each neighborhood. Median household income for New York City was $38,293 in 1999. Source US Census Bureau, Census 2000.

due to their parking privilege, are twice as likely as other city residents to commute to the Central Business District by auto. If Jackson Heights had more government employees, that could explain higher auto commuting. But in comparing the two neighborhoods, we found Park Slope residents are half again more likely to work for the government than are Jackson Heights residents. This suggests that more Park Slope residents would have government parking privileges and they would thus be more likely to commute by car.

CBD bound commuters are more likely than commuters to other parts of the city to use transit, Thus, a higher percentage of CBD bound commuters would result in lower auto use and the higher rate of commuting to the Manhattan CBD by Park Slope residents could result in the lower rate of auto commuting overall.

To test the relative effects of these factors we developed a mode choice probability model. See Appendix A for a technical description. The model estimates tell us that for every $1,000 increase in income commuters are 1% more likely to commute by car; people who own their own homes are 44% more likely to commute by car[6]; but people who work in Manhattan are 85% less likely to commute by car and if you work for the government your odds of commuting by car increase by 25%. As noted above, the study *Necessity or*

Table 2. Percent of Neighborhood Residents Employed in Local, State and Federal Government

	New York City	New York State	Federal	Total
Jackson Heights	6.3%	1.2%	2.4%	9.9%
Park Slope	10.3%	3.2%	1.8%	15.3%

Source: US Census Bureau, Census 2000. Table P51

[6] We include homeownership to improve the explanatory value of the model.

Table 3. Travel Time in Minutes: Jackson Heights and Park Slope to Midtown and Downtown Manhattan

	Park Avenue @ 42nd Street			Wall Street @Broadway		
	Automobile	Transit	Ratio	Automobile	Transit	Ratio
Jackson Heights[1]	23	40	1.7	35	57	1.6
Park Slope[2]	25	42	1.7	17	35	2.1

Source: Google Maps; Hopstop.com
[1]Measured from 37th Avenue and 79th Street
[2] Measured from 7th Avenue and 3rd Street

Choice? Why People Drive in Manhattan estimates government employees are twice as likely to commute by car[7].

Based on income, auto and home ownership, government employment and percentage of commuters to Manhattan[8], and assuming other things equal, the model predicts that Park Slope residents would be 5%[9] more likely to commute to work by car. Yet in practice Jackson Heights residents are 28% more likely to commute to work by car.
ployment centers are shown in Table 3.

The travel times to midtown are about the same from each neighborhood and by each mode. Most important for mode choice analysis, though, the ratio of transit to drive times are also the same. This suggests no additional benefit to either neighborhood of using one of the modes disproportionately. On the other hand, while travel time to Wall Street is higher for Jackson Heights residents, the ratio of transit to driving travel time for Park Slope residents is higher. This difference in ratios would suggests that, other things being equal, there is a greater advantage to Park Slope residents in driving to Wall Street than there would be for Jackson Heights residents. With the higher relative advantage to driving from Park Slope we would expect a higher rate of driving from Park Slope.

Based on these ratios we conclude that travel time is not a factor in explaining the CBD mode choice differences. Because we use a sketch model based on census data, rather than a travel demand model based on household travel survey data, we exclude further treatment of travel time.

Having ruled out several possible explanations we turned our study to the built environment and, in particular, to the availability of parking.

Parking

After considering the effects of income, auto ownership, government employment, transit access, and CBD travel time, we looked to other supply characteristics of the auto/

Photo: Will Sweeney
Figure 2. Typical Alley in Jackson Heights

Photo: Kyle Sundin

[7] Schaller, Bruce 2006. Op. Cit.
[8] Due to data restrictions we use all Manhattan, not just CBD, commuters.
[9] The result is based on 25 simulations.


Photos: Kyle Sundin

Figure 3. Typical block front for 1, 2 or 3 family streets in Jackson Heights

highway/street system to explain why, despite our expectation that Park Slope residents would be 5% more likely than their Jackson Heights counterparts to commute by car, it is the case that Jackson Heights residents are 28% more likely to commute by car and 45% more likely to commute to the CBD by car. To understand both curbside and off-street parking we surveyed the two areas. Our survey efforts and their results are described below in the respective sections on curbside and off-street parking. Surveying the neighborhoods brought us to a powerful explanation. With alleyways and a newer housing stock, Jackson Heights has more than twice as much off-street residential parking per residence, it has more than 2.5 times as much off-street parking per car-owning household and over six times as much "on-site" off-street parking, i.e. in driveways or on-site garages.

Curbside Parking

To estimate the on-street parking we selected a systematic, stratified random sample of streets in each of the neighborhoods. Appendix B provides details of the analysis. From our survey we estimated slightly more than 17 spaces per short, or avenue, block and 47 and 64 spaces per long, or street, block in Jackson Heights and Park Slope respectively.

Park Slope, the larger of the two areas has approximately 10,200 curbside spaces. Jackson Heights has about 6,900. On a per area basis that is 11,000 and 9,400 curbside spaces per square mile for Park Slope and Jackson Heights respectively. The limited number of driveways in Park Slope yields more curbside parking, amounting to an average of 36% more cars parked per street.


Photos: Rachel Weinberger

Figure 4. Typical block front for 1, 2, or 3 family streets in Park Slope

Photos: Rachel Weinberger

Figure 5. Typical block front for 1, 2, or 3 family streets in Park Slope (left image) and more recent construction in Park Slope with driveways and garages (right image).

Off-Street

As shown in Table 4 and illustrated in Figures 2 and 3, Jackson Heights also has close to six times as much convenient, "on-site" residential parking per car owning family — much of it in local alleyways or front driveways. Jackson Heights has 22 times more alleyways than Park Slope. Figure 1, on page 2, illustrates the extent of alleys in each neighborhood. Figures 2, 3, 4 and 5 show typical streetscapes in each neighborhood.

In Jackson Heights, 62% of the housing units were constructed in 1940[10] or more recently. Arguably this is since the onset of the auto-age, as marked by the 1939 World's Fair. By comparison only 21% of the housing units in Park Slope have been built since 1940. **More important, though, 16% of the housing units in Jackson Heights, as opposed to 8% of the units in Park Slope, have been constructed since the 1961 zoning revision, thus they have been built with driveways and garages**. Subsequent zoning revisions require parking be provided at the rear or side of a residence, instead of in-front.

To estimate off-street parking, we used the Department of City Planning's Primary Land Use Tax Lot Output (PLUTO) database for 2007 and the Department of Consumer Affairs (DCA) list of licensed garages. We supplemented these data with field work and information from the commercial website BestParking.com.

PLUTO lists the garage area in square feet for every lot in the city, except for small buildings. Importantly, the database does not include garage or driveway area for one, two or three family buildings. For these small buildings we estimated off-street parking. The sampling strategy is outlined below and detailed in Appendix C. There are some discrepancies between the PLUTO data and actual conditions. To correct for that, we sampled garages in the neighborhoods. We found that in Park Slope about 10%, and Jackson Heights 2%, of the square footage reported as garages or surface lots have been converted to construction sites. Records for a few lots indicated errors in recording. Where our field survey confirmed the actual condition, we adjusted these figures accordingly. We matched PLUTO data against the DCA database to distinguish between residential and commercial lots. We found discrepancies in the DCA database as well. For example, addresses were given for parking lots but did not have any parking space associated with them. The most egregious example we encountered was a listing for a 530-space lot in Park Slope; our field survey found no lots at or near the indicated address.

Having established the square footage allocated to garage space for buildings of four units or greater we converted that square footage to parking spaces by assuming that one space requires 300 square feet. We excluded commercial accessory parking, for example hospital parking lots, which are used by customers and employees.

To account for garages and driveways, associated with small buildings we conducted a field survey of approximately 10% of the small (one-, two- and three-family) residential buildings in each neighborhood. A systematic sample of groups of blocks in each neighborhood was chosen. Surveyors then counted the number of parking spaces in garages and driveways of the small buildings in those blocks. Conservatively we assumed there was no tandem parking, i.e. driveways leading to one car garages were counted as just one space. If there was any doubt as to the use of a space we did not include it in our count. These data were used to estimate

[10] 1940 is the first year the Census began collecting data on the age of the country's housing stock

Table 4. Off-street parking spaces in Jackson Heights and Park Slope

Type of parking	Jackson Heights	Park Slope
Parking lots	605	885
Driveways, garages and alleyways	3,030	535
Total off-street	3,635	1,420
Curbside	6,855	10,200
Total parking	10,490	11,620
Dwelling Units (from Table 1)	24,900	24,360
Off-street parking space per Dwelling Unit	14%	6%
Off-street space per car owning HH	37%	14%
"On-site" off-street per car owning household*	31%	5%
Total parking per car owning household	1.08	1.13

*"on site" refers to garage or driveway parking space on the same property or adjacent alleyway parking spaces "off-site" which refers to nearby garage parking.

garage and driveway parking for all small buildings in the two neighborhoods.

When all types of off-street parking are considered, Jackson Heights has 3,635 off-street parking spaces and Park Slope has 1,415 – a difference of 156%. Table 4, summarizes off-street parking by category in these neighborhoods.

As Table 4 shows there are 1.08 and 1.13 parking spaces per car owning household in Jackson Heights and Park Slope respectively. With more overall spaces in Park Slope we would expect Park Slope residents to find parking more easily which would ease the time cost or burden associated with auto use. Again we would expect this to contribute to more auto use by Park Slope residents.

But it is private parking that tips the scales. Jackson Heights has more than six times as many off-street parking spaces in attached garages and driveways or in back alleys. Our survey of 160 one- two- and three-family buildings in Jackson Heights found 275 off-street parking spaces, or 1.09 spaces per unit in small buildings. In Park Slope, our survey of 559 small buildings found 64 off-street parking spaces, or .05 spaces per unit in small buildings. Applying these factors to the neighborhoods we estimate 0.14 off-street spaces per dwelling unit in Jackson Heights and 0.06 spaces per dwelling unit in Park Slope. Given the rates of auto ownership listed in Table 1 and vacancy rates for the neighborhoods we estimate that **37% of Jackson Heights residents who own cars have access to off-street parking as compared to only 14% of Park Slope residents, and 31% have access to on-site, private spaces compared with 5% in Park Slope**.

These results indicate that off-street parking could well account for Jackson Heights' higher auto share for CBD commutes and could very likely explain the higher auto mode share to other destinations. Furthermore, because the level of auto ownership is similar in the two neighborhoods, these results suggest that ease of access is critical in determining whether a car will be used for commuting. With few attached garages and driveways, car owners in Park Slope generally have to search for curbside parking or pick up and drop off their car at a nearby, or distant, lot. Parking is much easier and, therefore less costly in time in Jackson Heights.

With on-site space available to 31% of car owning residents of Jackson Heights compared to 5% of car owning Park Slope residents, Jackson Height residents are six times more likely to park their cars in attached garages and driveways. For them there is no search time, no valet notification, and no additional time to walk home.

Conclusion

Suburbanizing the City showed how the economics of required off-street parking shifted the decision of whether or not to own a car. Here we show how the economics of off-street parking effect the decision of when people use their cars.

Jackson Heights, is a relatively dense neighborhood that is well served by transit. We compare it with Park Slope, a slightly lower density area with higher auto ownership, higher income, a higher incidence of government employees and a worse transit to drive time ratio for access to lower Manhattan. These indicators all have a positive effect on auto mode share, meaning as income, percent government employees and car ownership increase more people will drive to work; as density decreases, auto mode share will also increase. At the same time, Park Slope has a greater share of its employed

residents commuting to Manhattan which is negatively associated with auto mode shares meaning that auto mode share decreases with increased commuters to the CBD, thus offsetting the higher expectation of auto commuters. Controlling for these factors, our model predicts Jackson Heights and Park Slope commuters will drive at roughly equal rates with Park Slope commuters about 5% more likely to drive. But Jackson Heights residents, with over two times more off-street parking and six times more driveway parking, are 28% more likely to drive in general and 45% more likely to commute by auto to the CBD.

The mode a commuter selects is a function of the relative advantages of each option[11]. When parking is scare or hard to find at either or both ends of the trip the relative advantage of transit exceeds the advantages of automobile use. The use of parking placards is an example of how easing parking at the destination end of a trip changes the relative advantages of driving versus using transit[12]. The presence of a guaranteed off-street parking spot –particularly if it is on site—eases parking at the origin end of a trip and greatly increases the likelihood that people in New York City will use cars even for trips that are well served by transit.

Finally, it is worth noting that the additional off-street parking found in Jackson Heights comes most frequently at the expense of green space as front and rear yards are converted to alleys or driveways in order to accommodate cars.

[11] Ben-Akiva Moshe and Steven Lerman. 1985. Discrete Choice Analysis: Theory and its Application to Travel Demand, The MIT Press, Cambridge Massachusetts; London, England.
[12] Schaller, Bruce 2006 op. cit.

Appendix A: Mode Choice Sketch Model

Introduction:

The most frequently used model specification for binary choices –i.e. an individual's choice between two possible outcomes—is the binary logit model. In this example we use the binary logit model to study the choice that employed New York City residents make with respect to what mode they use for their journey to work. We divide the choices between those who drive and those who do not drive. The former category includes carpoolers and people who drive alone; the latter category includes all others, hence, people who walk to work, take transit, bicycle or even work at home. The model predicts a probability that a household will select one option/outcome over the other, when aggregated over a neighborhood those probabilities yield the percentage of the population who choose each option.

For this research our objective was to both explain and predict mode choices at a sketch planning level. A mode choice model used in travel demand forecasting or facilities planning would include additional variables that were not available for this study. Given the limited data, we do not expect a level of accuracy required for travel forecasting but we expect the model to yield insight into the factors affecting mode choice and the direction (either amplifying or depressing) of that effect.

Data and Model Specification

Estimation

We estimated several models using the Public Use Micro Sample (PUMS) of the United States Census. The PUMS data is a 5% sample of the Census Bureau's long form responses. We are interested in how people who live outside of Manhattan travel to work whether they work in the Manhattan CBD or elsewhere in the city or region. We used only records pertaining to employed, New York City, non-Manhattan residents. We further limited the data to exclude the wealthiest 9% of the sample–i.e. those earning higher than $200,000 per year; the exclusion improved the model's explanatory power by almost 5%. The data consist of 91,130[1] disaggregated full responses to the census long form questionnaire. Hence, rather than having data aggregated to the block or tract level, data are available at the household level; income levels, car ownership levels and other socio-economic details of people by their different commute modes are known.

The shortcomings of the PUMS data for travel demand forecasting are that place of residence is known only at a fairly high level of aggregation and place of work is known only at the county level. For detailed studies these locations must be known with greater specificity which is why forecasting is typically done using a household travel survey rather than census data.

[1] When weighted by the census weight factors these records represent over 2.2 million New Yorkers.

Model specification:

The model is a binary logit choice model that predicts the probability that a person will drive which we denote as *P*(*drive*):

$$P(drive) = \frac{e^{\alpha+\beta i \cdot Xi}}{1+e^{\alpha+\beta i \cdot Xi}}$$

α and β are estimated parameters with α an estimated intercept and β a vector of *i* parameter estimates. To avoid potential colinearity conflicts and over specification we use the most parsimonious variable set we can to both explain and predict mode choice at the sketch level. Variables included in the model are:

- Household income
- Car ownership
- Housing tenure (whether or not the resident owned their home)
- Employment by the government
- Employment in Manhattan

These variables give a reasonable model fit with pseudo R-square statistics of .256 (Cox & Snell) and .345 (Nagelkerke) respectively, these indicate that our selected set of variables explains between 25% and 35% of the variation in mode choice among residents of the Bronx, Queens, Brooklyn and Staten Island. Additional factors to explain mode choice in a forecasting model would include travel time and cost by all the possible modes for the actual origin and destination. For the sketch model we rely on implied average values for travel time and cost based on the experience of all non-Manhattan resident New Yorkers. Other acknowledged but seldom tested factors in mode choice include parking availability at the destination of a trip and other built environment elements such as walking environment and street connectivity.

The parameter values are given in the table below:

Table A-1. Parameter Estimates

Variable	B	S.E.	Wald	Sig.	Exp(B)
Income (000)	0.01	0.00	956.94	0.00	1.01
Home ownership	0.36	0.02	475.10	0.00	1.44
Auto ownership	1.68	0.02	7092.26	0.00	5.37
Manhattan employment	-1.87	0.00	10495.73	0.00	0.15
Government employment	0.22	0.02	125.50	0.00	1.25
Constant	-1.55	0.02	6595.87	0.00	0.21

Application

Following a standard modeling approach, such as that used by New York Metropolitan Transportation Council with the Best Practices Model, we simulated several thousand households that matched key neighborhood characteristics of Jackson Heights and Park Slope.

Using a normal (μ,σ^2) probability distribution we simulated household income. The mean and variance were derived from the census tract data. Using binomial distributions with parameter *p* we simulated home ownership, auto ownership, Manhattan employment and government employment. The parameters for p were also derived from tract data. The table below shows the census data and our simulated set of households.

Table A-2. Simulated Households and Census Estimates

	Park Slope		Jackson Heights	
Variable	Census	Simulation	Census	Simulation
Home ownership	34.0%	34.0%	26.6%	27.4%
Auto ownership	42.4%	41.8%	38.9%	38.7%
Manhattan employment	52.1%	51.8%	41.1%	42.5%
Government employment	15.3%	15.6%	9.9%	9.8%
Income	$60,700	$59,200	$39,500	$39,700

Applying the estimated model parameters to the synthetic households yields a prediction, *ceteris paribus*, of roughly 30% auto commuters from Jackson Heights and 32% from Park Slope. Thus it over predicts auto mode share for both neighborhoods. The value in the model, however, is not as a travel demand forecasting tool but a sketch level model that yields insight into the relative behaviors of residents of the two neighborhoods.

Appendix B: Curbside Parking Estimates

	Curbside Parking	
	Jackson Heights	Park Slope
Number of street blocks	96	119
Number of avenue blocks	135	150
Streets surveyed	28	25
Avenues surveyed	23	23
Average space/street	47.10	64.04
Average space/avenue	17.30	17.43
St. dev. street	17.10	6.70
St. dev. avenue	6.20	2.97
Finite population correction (streets)	0.29	0.21
Finite population correction (avenues)	0.17	0.15
S.E.E. streets	2.29	1.06
S.E.E. avenue	1.07	0.52
90% C.I lower bound (streets)	43	62
90% C.I upper bound (streets)	51	66
90% C.I lower bound (avenues)	15	17
90% C.I upper bound (avenues)	19	18
Estimated parking on streets	4,522	7,589
Estimated parking on avenues	2,336	2,615
Total estimated spots	6,858	10,203
Lower Bound streets	4,148	7,374
Upper Bound	4,896	7,803
Lower Bound avenues	1,484	1,959
Upper Bound	2,584	2,749
Lower Bound total	5,632	9,333
Upper Bound	7,480	10,553
Off-street spaces	3,633	1,416
car accommodation	10,491	11,619
Number of vehicles (per U.S. census)	11,625	11,875
Saturation	1.11	1.02
Area	0.73	0.93
Curbside space / area	9,394	10,971
Total parking spaces / area	14,371	12,494

Appendix C: Off-Street Parking Estimates

To estimate the provision of off-street parking in Jackson Heights and Park Slope, we relied on official data sources and a field survey.

The Department of City Planning's PLUTO database provides detailed information on every tax lot in the city. For this study, we looked at the building class (BldgClass), lot area (LotArea), and garage area (GarageArea). In estimating the number of parking spaces provided by a lot, we assumed that spaces consume an average of 300 square feet.

We also looked at a database of parking garages and lots maintained by the Department of Consumer Affairs (DCA). The data include the number of spaces in each commercial garage or lot.

Through a field survey, as well as scans with Google Earth to verify data on specific lots, we found a number of errors in the DCA and PLUTO databases:

- Nine percent of the square footage in Park Slope that was identified as garage space – and two percent in Jackson Heights – was found to be under construction or converted to other uses. One lot in the DCA database could not be found.
- Several Park Slope lots that PLUTO identified as garages or parking lots had a garage area of zero. Where a scan with Google Earth or field work suggested that the lot was open for residential parking, we used the lot area field as an estimate of the garage area. This increased the estimated inventory of residential parking by ten percent.
- The DCA database lists a few lots that PLUTO does not identify as garages. Where a scan with Google Earth or field work confirmed the existence of lots that are open for residential parking, these were added to the parking inventory. This increased the parking estimate for Jackson Heights by 48% and for Park Slope by 25%.

The field survey also identified garages that appeared to be dedicated to employee or customer parking; these lots were excluded from the total. Table C-1 summarizes these adjustments.

Table C-1. Adjustments to PLUTO and DCA Data

Neighborhood	Jackson Heights	Park Slope
Garage Area from PLUTO[1]	145,374	244,309
Less non-existent parking (from field survey)	(3,180)	(22,138)
Less dedicated customer/employee parking (field survey)	(19,219)	(34,033)
Plus lot area for parking lots with Garage Area = 0	0	23,496
Net residential parking	122,975	211,634
Convert to spaces	410	705
Plus DCA lots not in PLUTO	195	178
Total PLUTO+DCA parking	605	883

[1] Three PLUTO records for Jackson Heights listed garage areas of 1 square foot. These were assumed to be errors and the garage area was set at 300 square feet, or one parking space.

The most significant weakness of the PLUTO dataset is that it does not tabulate parking in residential buildings with three or fewer units. In Jackson Heights, driveways and garages at the front of such buildings and in back alleys provide a significant amount of residential parking.

To correct for this omission, we conducted a systematic sample of approximately 10% of the small (1-3 units) buildings in both neighborhoods. Four groups of three adjacent blocks were sampled in Park Slope and two such block groups were sampled in Jackson Height. Surveyors counted driveways and garages on the street and in alleys on these blocks. We did not count driveways that led to a garage, as we conservatively assumed that residents would park in either the garage or the driveway but not both.

Table C-2 summarizes the results of this survey

Table C-2. Driveways and Garages in Sampled Neighborhoods

	Jackson Heights	Park Slope
Sampled buildings	160	559
Sampled dwelling units	253	1179
Driveway and garage spaces counted	275	63.5
Spaces per building (sample)	1.72	0.11
Spaces per unit (sample)	1.09	0.05
Number of buildings with 1-3 units in neighborhood	1,762	4,688
Number of units in small buildings	3,229	10,299
Estimated driveway and garage spaces in neighborhood	3,028	533