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Analyzing internal rate of capture in New York City

PROJECT INTRODUCTION AND METHOD

ABSTRACT

This study sought to answer questions about internal rate of capture in New York neighborhood tabulation areas (NTAs) though use of multiple regression. As average trip distance increased, internal rate of capture decreased. A similar, but much weaker relationship exists between average auto vehicle miles traveled and internal rate of capture. Across NTAs, there was a significant difference in average trip distance and auto VMT between internal and non-internal trips. Internal trips relied much more heavily on walking trips, while non-internal trips more heavily utilized automobiles and public transit. All proxies for travel affecting factors- individual and household characteristics, system performance, and contextual factors-showed a positive correlation with internal rate of capture.

PROJECT TOPIC/INTRODUCTION

This study seeks to determine the correlation between internal rate of capture, average trip distance, VMT, and modeshare in New York neighborhood tabulation area (NTA). In addition, it looks at how different variables that affect travel behavior influence the above.

REFERENCES

Bochner, B. S., Hooper, K., Sperry, B., & Dunphy, R. (2011). Enhancing Internal Trip Capture Estimation for Mixed-Use Developments. doi:10.17226/14489

Gulden, J., Goates, J. P., & Ewing, R. (2013). Mixed-Use Development Trip Generation Model. *Transportation Research Record: Journal of the Transportation Research Board*, 2344(1), 98-106. doi:10.3141/2344-11

Tien, G., & Ewing, R. (2017). PALM BEACH COUNTY INTERNAL TRIP CAPTURE STUDY FOR MIXED USE DEVELOPMENTS. FAU Center for Urban and Environmental Solutions.

RELATED STUDIES

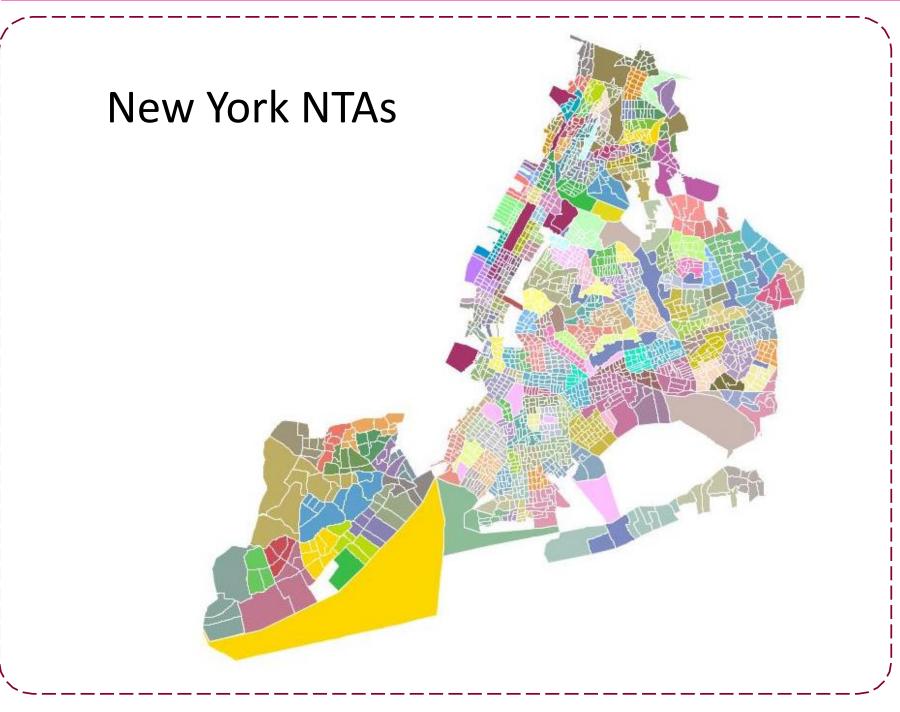
Previous studies focus on modeling internal capture for mixed use developments. Tien et al. estimated models of traffic generation in terms of standard built environmental variables. Gulden et al. estimated mode share and VMT on the basis of published travel characteristics. Bochner and Sperry estimated trip generation, factoring in land use and mode-share.

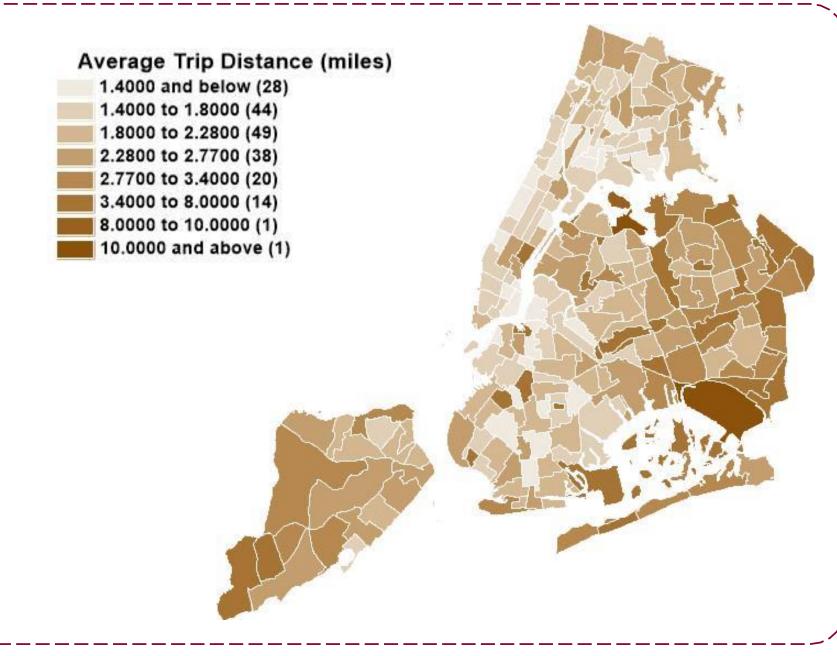
ANALYSIS PROCESS

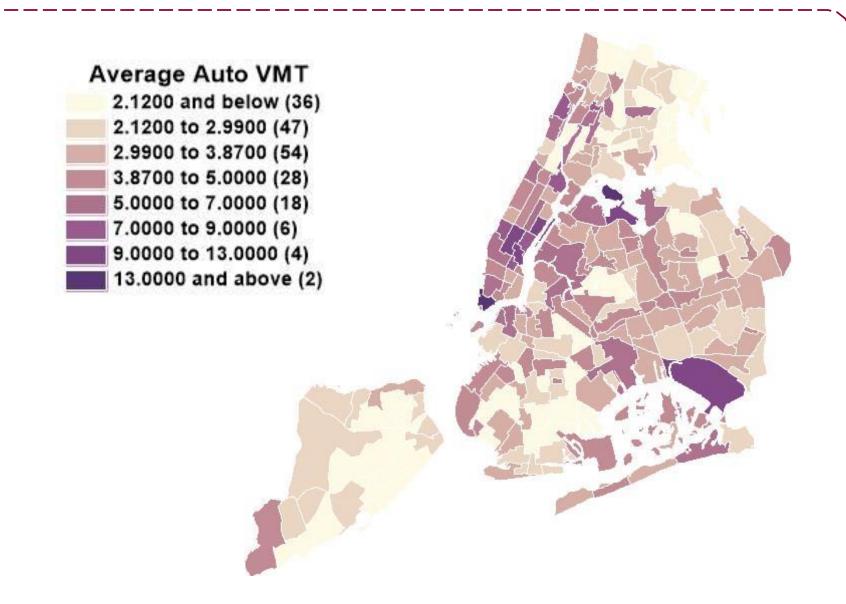
To calculate percent internal capture, the 2010-2011 Regional Household Travel Survey data collected by the New York Metropolitan Transportation Council and North Jersey Transportation Planning Authority was used. One subset of this data is unlinked trips, with each record being an unlinked trip or trip segment. Each record has an origin census tract and destination census tract, which were used as the geographic identifiers. Each census tract was tagged with the NTA it was in, using the Tiger and NTA shapefiles. Each record in unlinked trips was then tagged with the origin NTA and destination NTA using a join. Each record was then tagged as an internal, non-internal, or not applicable trip. Internal trips were those in which the origin NTA and destination NTA were the same. Non-internal trips were those in which the origin NTA did not equal the destination NTA. Not applicable trips were those in which neither the origin census tract or destination census tract were located within a NTA. The GroupBy function was then used to group by origin NTA. For each NTA, internal rate of capture, average trip distance, and auto VMT for internal and non-internal trips was calculated. This data was also derived from the unlinked trips database, using the trip mode and trip distance variables. A pivot table was made with each NTA as an individual record.

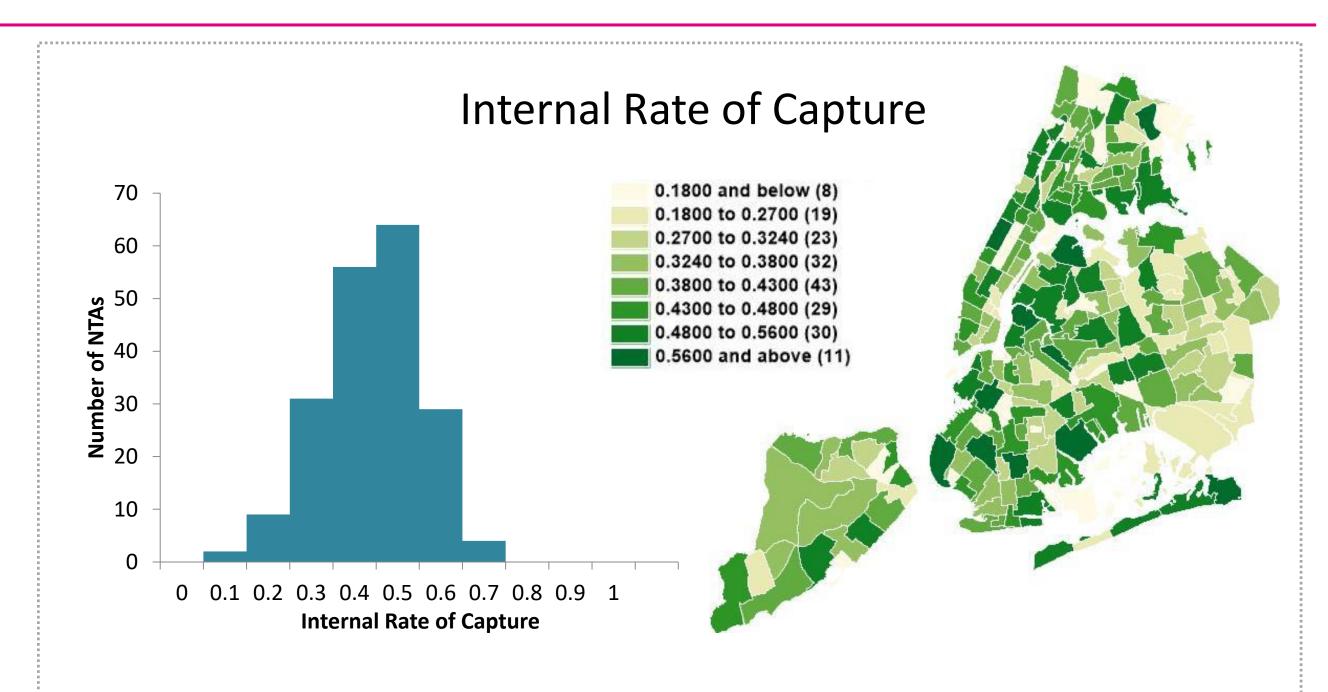
Mode share was also calculated for internal trips and non-internal trips, as each record in the unlinked trips file had the transportation mode. Proxies for the three main things that affect travel were derived from the Smart Location Database. A multiple regression analysis was run utilizing internal rate of capture as the target.

STUDY RESULTS









Mode Share

Internal trips utilized much higher rates of walking than non-internal trips and not applicable trips. Automobiles were used at much lower rates (9% vs 26% for non-internal and 83% for not applicable trips. Public transit was also used at a much lower rate for internal trips (6% versus 41%).

	Walk	Bike	Auto Driver	Auto Passenger	Carpool/ Vanpool	Public Transit	Other
Not internal	30%	1%	19%	7%	0%	41%	2%
Internal	84%	0%	6%	3%	0%	6%	1%
Not applicable*	12%	0%	64%	17%	0%	7%	1%

*neither trip origin or destination are within a NTA

Travel behavior

Proxies for the three main factors that affect travel were derived from the Smart Location database and used to explain internal rate of capture. Percent of 0-car households was used as a proxy for individual and household characteristics. Aggregate frequency of transit service per square mile was used as a proxy for system performance. Network density in terms of facility miles of multi-modal links per square mile was used as the contextual proxy. All factors were positively correlated with internal rate of capture. The confidence level for percent of 0-car households was between 99.8 and 99.9% (t=3.34). It was between 95 and 98% for aggregate frequency of transit service per square mile and network density (t=1.95, t= 2.24, n=195).

Variable	Estimate	Std. Error	T-test
Constant	0.064933	0.060662	1.07
Percent of 0-car households	0.524345	0.157184	3.34
Aggregate frequency of transit service per square mile	0.000014	0.000007	1.95
Network density (facility miles of multi-modal links per square mile)	0.017411	0.007777	2.24

CONCLUSIONS

There is some evidence that a NTA shapes a household's activity space. 40.72% of trips whose origin or destination are within a NTA were internal to that NTA. This is further supported by the relation between average trip distance and internal rate of capture (-0.036, r-squared 0.11). Across all NTAs, average trip distance is smaller for internal trips (0.25 vs 4.12 miles). Auto VMT is also smaller for internal trips (0.38 vs 5.00 miles). The use of active transportation is supported by urban design, which should be encapsulated by NTAs. 84% of internal trips were made by walking. In addition, average trip distance and auto VMT for NTAs is positively correlated (0.20, r-squared 0.16), suggesting that trips made by automobiles are longer. Internal rate of capture is positively correlated with the proxies for individual and household characteristics, system performance, and contextual factors. This shows that these factors are greater determinants of rate of capture.