An Economic Analysis of Complete Streets Policies in New Jersey

Abstract: In 2005, a coalition of advocacy and trade groups including the American Public Transportation Association and the National Association of Realtors founded the National Complete Streets Coalition. The Coalition aimed to advance so-called "complete streets," a transport policy and design approach that requires streets to be designed and operated to allow equal access to all people and major forms of transportation, rather than just motor vehicles. By 2013, more than 490 jurisdictions in United States had adopted a Complete Streets policy. The design principles include pedestrian infrastructure, traffic calming, and bicycle and public transit accommodations. The costs associated with planning, logistics and execution of these principles are high and take continued commitments to maintain. However, the literature includes no analysis of the benefits of this program. Consequently, this paper tests whether adoption of Complete Streets affects property values by examining changes in house prices for New Jersey municipalities that adopted Complete Streets compared to similar municipalities that did not. To construct these comparisons, the paper uses American Community Survey data to calculate propensity scores on adoption of Complete Streets. The results indicate that adopting Complete Streets raises average house prices by about $30,200. Using the average house sale price in the data set as the base, this reflects a 7 percent increase in average house prices (30,200/426,214).

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1. Introduction

According to the 2009-10 National Health and Nutrition Examination Survey, 2 in every 3 adults are overweight or obese, while 1 in every 6 children/teens between the ages of 6 and 19 are considered to be obese. A series of studies suggest that our car-dependent lifestyle is at least partly to blame. For instance, Frank et al. (2004) show that an additional hour spent in a car (per day) increased the overall likelihood of obesity by 6%. Moreover, the probability of obesity fell by 4.8% for each additional kilometer walked each day. Thus, public health experts contend that increasing pedestrian activity is an effective strategy for increasing population health.

However, the built environment in many locations can make walking a risky activity. Data from the United States Department of Transportation National Highway Traffic Safety Administration reveals that in 2013 on average a pedestrian was killed every 2 hours. In addition, a pedestrian was injured once every 8 minutes. 73% of pedestrian fatalities in 2013 took place in urban areas, and 69% of these fatalities were not at intersections.

As such, low levels of pedestrian activity may be the result of unsafe streets and safer streets may therefore produce healthier communities. Safer streets can also increase population health by reducing pollution. The Environmental Protection Agency (EPA) estimated that in 2013 that 27% of all greenhouse gas emissions stemmed from transportation. Consequently, the EPA advocates for reducing travel demand through urban planning designed to reduce travel by automobile. Following on this effort, the National Complete Streets Coalition (NCSC) advocates for accessible, safe and usable streets regardless the of the user’s age, health, or choice of transportation type.

These “Complete Streets” are defined as “(streets) designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities," and are meant to optimize and improve the ability, safety and ease of travel, shopping and other activities in the area. This is then achieved through planning and execution with the help of government organizations and engineers, with an emphasis on an overall pledge to commit to maintaining and continuing these newly "completed" streets.

The most important components of complete streets include, "sidewalks, bike lanes (or wide paved shoulders), special bus lanes, comfortable and accessible public transportation stops, frequent and safe crossing opportunities, median islands, accessible pedestrian signals, curb extensions, narrower travel lanes and roundabouts." (NCSC) Generally, complete streets components can be made up of any type of additional road alteration or modified architecture that provides safety or increased accessibility for the user. To put it very simply, an "incomplete" street would be defined as one designed that only for use by motor vehicles and is not safely accessible for anything or anyone else.

Complete Streets can be developed anywhere but obviously vary greatly depending on the area, government, amount of funding, population and many other factors. These complete streets are created through a Complete Streets Policy, which outlines the goals, planning, design and timeline to completion along with how to maintain and optimize them for the future. The municipality or organization specifies a definitive vision of what the policy will do for the area in question and builds their particular policies around that vision. From then on, it is up to the organization or government in question to carry out that policy.

The claimed benefits of these Complete Streets policies include increased safety, physical activity and health. Public transportation options also improve due to improved access and better planning. As a result of increased public transportation use, gas and oil consumption fall. As is typically the case, such benefits/amenities will be capitalized into land prices. Under such conditions, house prices rise.

Nevertheless, the costs associated with planning, logistics, and execution of these principles are high and require continued commitment. Thus, evidence of benefits would help support expenditures designed to achieve the goals of Complete Streets. However, the literature includes no analysis of the benefits of this program. Consequently, this paper tests whether adoption of Complete Streets affects property values by examining changes in house prices for New Jersey municipalities that adopted Complete Streets compared to similar municipalities that did not.

To construct these comparisons, the paper uses American Community Survey data to calculate propensity scores for adoption of Complete Streets. We then use the propensity scores to construct a natural experiment. In our experiment, we construct pairs of municipalities with similar propensity score where one municipality adopted Complete Streets while the other did not. We then compare house prices across the municipalities before and after the adoption of Complete Streets using a difference-in-difference design.

2. Literature Review

While there are no evaluations of the economic effects of these Complete Streets policies, it is important to take note of the research on design elements and ideas embodied in Complete Streets. Some of these elements include safety, road features, transportation, public urban planning, accessibility and logistics. A series of papers assess valuations of road features. Dumbaugh (2005), Dumbaugh and Rae (2009) and Dumbaugh and Li (2001) show that slower speeds and less traffic conflicts (where paths are crossed directly) are more important determinants of safety than simply developing more forgiving roads. Reducing the number of these traffic conflicts, such as multiple way intersections and other traffic hazards has the greatest positive influence to overall safety of those using the streets. Ultimately, the most effective methods to cut the number of vehicular crashes or accidents are to reduce speeds and good urban planning of the environment, both of which are relevant and significant goals of the Complete Street vision for their policies and plans.

Saelens, Frank and Sallis (2003), describe the environmental aspects more likely to promote cycling and walking. Biking and walking is significantly more common in areas with high population densities, high connectivity, varying land usage, and proper and adequate design for travel either by biking or walking. These characteristics also align with the goals and objectives of Complete Streets and as such would predict such an outcome for an area with such policies over one without.

Parker et al. (2013) compares the number of cyclists traveling streets before and after bike lanes were built in New Orleans. They find that more individuals overall traveled post creation of the bike lanes. Moreover, bikers also became more likely to travel with the flow of traffic following construction of the bike lanes. One street went from a mean number of cyclists per day of 74.9 in 2009, to 258.3 in 2010 following the creation of the bike lanes. The results show that the additional bike lanes provide a positive effect not only on the number of bikers in the particular area, but also increased adherence to traffic, thus helping to provide a more "healthy neighborhood."

Boarnet et al. (2005) analyzes the impacts of ten individual traffic improvements by individual schools through this particular program. These traffic improvements included sidewalk gap closures, new pathways and signage, replacement of four way stop signs with traffic lights, bicycle paths, and improved crosswalks or added crosswalk signals. While each of the effects over the 10 different schools varied, between 69% and 87% of parents agreed that the project made biking and cycling safer for their children. Three schools in particular saw large jumps in percentage of students walking on their sidewalks after the projects, with one school increasing from 35% to 65%, another from 58% to 96% and a third from 25% to 95%. These were massive changes that ultimately denote a huge change in perception of safety and increased activity as a result.

Handy and McCann (2011) consider the factors that determine spending on bike and pedestrian viable paths for transportation in metropolitan areas. They find that first and foremost local support is the most direct factor, with state and metro area policies more "symbolic" in nature rather than driving forces. While local support was the largest factor, the variation in the other factors did not provide clear enough evidence to rank them solely based on effect and importance.

The National Economic Council and the President's Council of Economic Advisers (2014) expressed in a recent study the effect on property prices in regards to transportation infrastructure improvements. According to Weinstein et al. (1999), total property valuations were increased by 25% where light rail stations were established in Dallas neighborhoods over those without them. A premium effect was noted for overall property values in cities such as St. Louis, Chicago, San Diego and Sacramento when public transit systems were available.

While all of these prior pieces of research do not directly evaluate Complete Streets, each and every one does contain information relevant to the concept and goals of these types of policies, along with validating some of the claims that the National Complete Streets Coalition makes about the benefits of those policies.

3. Data and Methods

To accurately gauge the effect of a Complete Streets policy on average house prices, we need to control for selection bias. If communities with certain characteristics are more likely to choose to enact Complete Streets and those characteristics are associated with higher property values, then a comparison of municipalities that have adopted Complete Streets with those that have not will be misleading. That is, we may infer that Complete Streets caused the difference in house prices when, in fact, a series of community characteristics are causing both the higher house prices and the adoption of Complete Streets.

To prevent selection bias, we assembled data from the American Community Survey 5-year estimates in 2010 for 324 boroughs or cities in the state of New Jersey. We joined this data to a list of New Jersey municipalities that adopted Complete Streets from 2009-2014. We dropped municipalities that adopted Complete Streets in 2013 and 2014 from the analysis to ensure that we had a sufficient time period following adoption to track changes in house prices. Using the remaining data, we coded a dummy variable to take the value of 1 for all municipalities that adopted Complete Streets from 2009-2013 (no adoptions occurred prior to 2009).

We then regressed (using probit) the dummy for Complete Streets on a series of community characteristics including population, the ratio of car trips to total trips, median income, percentage of structures built prior to 1940, population density, and distance to New York City. Using the predicted values from this analysis (propensity scores), we created groups of two or three municipalities. The groups were selected to meet three conditions: 1) at least one municipality adopted Complete Streets while at least one municipality did not; 2) all members had roughly equivalent propensity scores; and 3) all members were located in the same county.

We chose to compare only locations within the same county because counties have different policies with regard to road design or may have adopted Complete Streets. By limiting the comparisons to an "in county" boundary, we eliminate the effects of cross-county differences.

Ultimately, we created 12 groups (11 pairs and one group of 3). Because of this selection process, we may analyze the data using a difference-in-difference design. Treated municipalities adopted Complete Streets while control municipalities did not. To capture this, we created a dummy variable (Treat) that took the value 1 for treated municipalities and 0 for control municipalities. Complete Street adoption years, which varied across the groups, were used to create a dummy variable (Post) that captured adoption year. Post took the value 1 for all years following adoption of Complete Streets for all members of the group and 0 otherwise. To identify the causal effect of Complete Streets, we interact Treat and Post. Thus, the Treat*Post variable takes a value of 1 for treated municipalities in the years following adoption of Complete Streets. We then regressed average municipal residential sales price data on these dummies and a set additional controls. The average municipal residential sales price data is from the State of New Jersey Department of the Treasury taxation division for years 2007 to 2015.

4. Results

Table I reports means and standard deviations for the data we used to calculate the propensity scores as well as the house price data we used measure the impact of Complete Streets. From Table 1, 15.7 percent of the sample used to create propensity scores adopted Complete Streets. For the remainder of the variables in this portion of the analysis, average population for sample municipalities is 11.9 thousand, median family income is about $76,900, and population density is about 6.5 people per acre. Car ratio is the ratio of car trips to total trips.

About 83% of total trips are car trips and about 27% of structures were built prior to 1940 for the municipalities in our sample. Finally, the average municipality is about 45 miles from New York City. For the house price analysis that we use to measure the value of Complete Streets, the average house price is about $426,000.

Table II reports the results of the probit analysis we used to create the municipality groups described above. The parameter estimates are marginal values. The results show that population and distance from New York City have a positive and significant effect on the probability of adopting Complete Streets while car ratio has a significant effect of the probability of adopting Complete Streets. A municipal population increase of 1,000 raises the probability of adopting Complete Streets by 0.31 percent. An additional mile from New York City reduces the probability that the municipality adopts Complete Streets by 0.016 percent. Finally, increasing the proportion of trips that are car trips by 10 percentage points reduces the probability of adopting Complete Streets by 9.2 percent.

Table III reports the groups we construct from the probit analysis reported in Table II. In each case, the propensity scores are nearly the same, at least one municipality has adopted Complete Streets while at one municipality has not, and the municipalities in each group are drawn from the same county. We use these groups to construct our data on average house prices by municipality for the period 2007 to 2015 and then regress house prices on the Treat, Post, and Treat*Post variables described above. The results of these regressions are reported in Table IV. Table IV reports three specifications. The first two specifications are random-effects generalized least squares regressions with average house price by municipality as the dependent variable. In the first specification, we control for changes in market conditions over time using a set of year dummies. The second repeats the first specification but includes an additional control for group number. The third specification is a fixed effects regression with average house price by municipality as the dependent variable.

In each case, the variable of interest (Treat*Post) is significant and positive. The results, consistent across all three specifications, indicate that adopting Complete Streets raises average house prices by about $30,200. Using the average house sale price in the data set as the base, this reflects a 7 percent increase in average house prices (30,200/426,214). Interestingly, the Post estimates across the three specifications are negative and have roughly the same absolute value as the Treat*Post estimates (-$31,087, -$29,356, and -$31,609). This implies that locations without Complete Streets policies had on average a $30,000 decrease in sales price while locations that adopted Complete Streets showed no net change in house prices (over the period following the adoption of Complete Streets). Finally, we note that group number (which rises with propensity score) is positively and significantly associated with average house price.

5. Conclusion

This paper analyzes the impact of Complete Streets an initiative launched in 2005 by a coalition of advocacy and trade groups including the American Public Transportation Association and the National Association of Realtors. The coalition aimed to advance a transport policy and design approach that requires streets to be designed and operated to allow equal access to all people and major forms of transportation, rather than just motor vehicles. The design principles include pedestrian infrastructure, traffic calming, and bicycle and public transit accommodations. The costs associated with planning, logistics and execution of these principles are high and take continued commitments to maintain. However, the literature includes no analysis of the benefits of this program.

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Bibliography

Boarnet, M. G., Day, K., Anderson, C., McMillan, T., & Alfonzo, M. (2005). California's Safe Routes to School Program. *Journal of the American Planning Association*, *71*(3), 301-317.

Dill, J. (2009). Bicycling for Transportation and Health: The Role of Infrastructure. *Journal of Public Health Policy, 30* S95-S110.

Dumbaugh, E. (2005). Safe Streets, Livable Streets. *Journal of the American Planning Association*, *71*(3), 283-298.

Dumbaugh, E., & Li, W. (2011). Designing for the Safety of Pedestrians, Cyclists, and Motorists in Urban Environments. *Journal of the American Planning Association*, *77*(1), 69-88.

Dumbaugh, E., & Rae, R. (2009). Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety. *Journal of the American Planning Association, 75*(3), 309-329.

Handy, S., & McCann, B. (2011). The Regional Response to Federal Funding for Bicycle and Pedestrian Projects. *Journal of the American Planning Association*, *77*(1), 23-38.

Parker, K. M., Rice, J., Gustat, J., Ruley, J., Spriggs, A., & Johnson, C. (2013). Effect of bike lane infrastructure improvements on ridership in one New Orleans neighborhood. *Annals of Behavioral Medicine*, *45*(Suppl 1), S101-S107.

Saelens, B. E., Sallis, J. F., & Frank, L. D. (2003). Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine*, *25*(2), 80-91.

Smart Growth America. (n.d.). Welcome to the National Complete Streets Coalition. Retrieved December 20, 2016, from http://www.smartgrowthamerica.org/complete-streets

Flegal KM, Carroll MD, Kit BK, Ogden CL. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999–2010. Journal of the American Medical Association. 2012; 307(5):491–97.

Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. Journal of the American Medical Association. 2012; 307(5):483–90.

Traffic Survey Facts - 2013 Data. (n.d.). Retrieved January 17, 2016, from http://www-nrd.nhtsa.dot.gov/Pubs/812124.pdf

Sources of Greenhouse Gas Emissions. (n.d.). Retrieved January 18, 2016, from http://www3.epa.gov/climatechange/ghgemissions/sources/transportation.html

Frank, L.D., Andresen, M.A., and Schmid, T.L. (2004). "Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars." American Journal of Preventative Medicine 27:2.

Weinstein, B. et al. "The Initial Economic Impacts of the DART LRT System." Center for Economic Development and Research, University of North Texas, 1999.

Table I: Descriptive Statistics

Variable Name	Mean	Standard Deviation	Min	Max	Observations
Adoption of Complete Streets	0.1575342	.3649291	0	1	292
Population per 1000	11.90648	25.43663	.004	274.674	292
Car Ratio	0.8321935	0.1027117	.293925	1	291
Median Income	76902.73	30923.81	25682	250000	291
PreWar Structures	.2664128	.1637221	0	.910256	291
Density	6.496416	7.775884	.0210016	75.0685	292
Distance from NYC	45.32911	31.75117	2.9	131.9	292
Average Home Sales Price	426214	163319.8	156019	881420	222

Table II: Probit Regression Results for Complete Streets Adoption

	I
	Adoption of Complete Streets
Population (in thousands)	.0031345 **
	(.0015382)
Car Ratio	-.9189984***
	(.2388895)
Median Income	4.96e-07
	(7.08e-07)
PreWar Structures	.1209022
	(.1239936)
Density	-.0027495
	(.0031109)
Distance from NYC	.0016584**
	(.000737)
Pseudo R2	0.1494
Wald Chi2	30.16
Observations	291

Heteroskedastic Robust Standard Errors in Parentheses
* = Significant at 0.10
** = Significant at 0.05
*** = Significant at 0.01

Table III: Groupings

NJ Municipality	Complete Streets Adoption Year	Predicted adoption	County
Group 1			
Netcong borough	2010	0.0428873	Morris
Riverdale borough	-	0.046359699	Morris
Group 2			
Franklin borough	-	0.059826899	Sussex
Hopatcong borough	2012	0.052023198	Sussex
Group 3			
Manville borough	-	0.064151898	Somerset
Raritan borough	2011	0.063047796	Somerset
Group 4			
Maywood borough	2011	0.081486903	Bergen
Harrington Park borough	-	0.081638999	Bergen
Group 5			
Bogota borough	-	0.095104001	Bergen
Emerson borough	2010	0.097116701	Bergen
Group 6			
Matawan borough	-	0.1037798	Monmouth
Monmouth Beach borough	2010	0.102732897	Monmouth
Oceanport borough	-	0.1036935	Monmouth
Group 7			
East Rutherford borough	-	0.198180601	Bergen
Rutherford borough	2011	0.193096995	Bergen
Group 8			
Asbury Park city	-	0.2183927	Monmouth
Fair Haven borough	2012	0.219215304	Monmouth
Group 9			
Wildwood Crest borough	-	0.236683398	Cape May
Woodbine borough	2012	0.231412098	Cape May
Group 10			
Fort Lee borough	2012	0.253595591	Bergen
Leonia borough	-	0.2380936	Bergen
Group 11			
Ocean City	2011	0.284836411	Cape May
West Cape May borough	-	0.287431896	Cape May
Group 12			
Edgewater borough	-	0.375207812	Bergen
Ridgewood village	2011	0.379630893	Bergen

Table IV: Regression Results for Average Home Sale Price

	I	II	III
	Average Home Sale Price	Average Home Sale Price	Average Home Sale Price
Treat	65418.55	63908.97	-
	(62080.64)	(52486.49)	-
Post	-31087.24***	-29356.68**	-31609.91**
	(11897.61)	(12014.33)	(12017.97)
Treat Post	30194.22**	30252.51**	30186.86**
	(14339.4)	(14366.41)	(14320.43)
Year 2	-19674.36***	-19674.36**	-19674.36**
	(7710.79)	(7729.215)	(7692.497)
Year 3	-61777.54***	-61564.83***	-61922.16***
	(11546.5)	(11583.63)	(11517.73)
Year 4	-66787.04***	-67278.59***	-66639.81***
	(12823.3)	(12882.97)	(12780.95)
Year 5	-42533.79***	-43729.22***	-42176.01**
	(15886.03)	(15964.92)	(15938.46)
Year 6	-70013.5***	-71772.05***	-69487.3**
	(17668.05)	(17747.38)	(17781.26)
Year 7	-59039.58***	-60798.13***	-58513.38***
	(17178.89)	(17315.54)	(17160.46)
Year 8	-42771.32***	-44315.88**	-42389.89**
	(17754.87)	(17929.2)	(17758.25)
Year 9	-16168.61	-17713.17	-15787.18
	(30335.89)	(30470.59)	(30289.39)
Group	-	21346.82***	-
	-	(6043.262)	-
Cons.	443593.3***	295744.1***	477702.4***
	(40034.78)	(61140.49)	(9191.177)
Cross Section FE	Yes	Yes	Yes
Times Series FE	Yes	Yes	Yes
R-Squared	0.1006	0.3722	0.0551
Wald Chi2	177.74	197.74	-
F-Stat	-	-	16.20
Observations	222	222	222

Heteroskedastic Robust Standard Errors in Parentheses
* = Significant at 0.10
** = Significant at 0.05
*** = Significant at 0.01