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Property value changes from public transportation: How the Greenbush Commuter line affected property values

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Abstract

Prior studies have investigated the impact on property values to the proximity of established public transportation stations. Public transportation is thought to increase value of towns and properties, giving residents more options for transportation to and around the city. Both benefits and consequences of public transportation exist, allowing for either a raise or lower of property values in towns with stops. This paper analyzes the Greenbush Commuter line in Massachusetts, seeing if the proximity to the stops has an affect on the property of values in the towns. A difference – in – difference model is used to investigate a difference in property value changes between the near houses and the far houses. Results show that no statistical difference between the changes in property values of near houses compared to far houses. Potential benefits and consequences of the Greenbush line may mitigate each other, leading to no difference in the change of property values.

Keywords

Greenbush, property values, public transportation

Cover Page Footnote

I would like to thank Professor Nathan W. Chan, of the Economics department at Colby College, for his help and support of the data collection and analysis.

Introduction

The cost and availability of public transportation can be a deciding factor for residents when weighing the options of whether to live in a city or in the suburbs. Public transportation is a critical aspect for cities, allowing residents to freely travel in and out of cities without the hassle of a car. Additionally, new public transportation has benefits and consequences for not only the town they are in, but also neighboring towns and the city as a whole. Benefits of public transportation are cheaper means of transportation, typically consistent schedules, and easy, local access. Consequences of public transportation can include added construction or infrastructure in a town, noise pollution, and congestion around the stops. All routes and types of public transportation are different, making the benefits and consequences at each one differ slightly. Typically, it is thought that public transportation is beneficial for towns, giving residents easier access and availably to the city. However, when new public transportation is constructed, it is often unclear whether the benefits will still out way the consequences in that specific location.

The Greenbush Commuter line of the Mass Bay Transportation Authority originally ran for about 100 years on the South Shore, stopping in 7 towns, with Boston, MA being the final destination, but was shut down in 1959. For about 20 years there was no use or talk of the commuter line or any other form of public transportation to the South Shore. In 1980, officials on the South Shore began talking of reinstating the old commuter rail, but it wasn't until about 1990 that South Shore officials submitted the Greenbush line to the federal government in order to receive funding. However, due to too much local opposition, the Greenbush line did not receive funds for the construction.

Residents along the Greenbush line had become accustomed to it being abandoned and had many concerns about the construction of the line again. With 28 grade crossings, much of the resident's concerns came from safety, causing the MBTA to roll out a major public safety campaign. Other resident's concerns included increase noise levels, traffic jams at grade crossings, aesthetically mar the neighborhoods through which the new rail service would run, and decreased property values from the noise and congestion. All these concerns forced the MBTA to work with the towns alone the line, trying to mitigate concerns and win over public support. The MBTA limited environmental impact and noise pollution by constructing multiple tunnels and soundproofing of homes and businesses located near the railroad tracks. Public opposition, which created legal and political delays and ensuing mitigation, delayed the opening of the line for many years and resulted in greatly increased costs. Construction eventually began in 2003, and the commuter line was open to the public on October 31, 2007.

This research aims to answer the question of whether the implementation of the Greenbush Commuter Rail line, in October 2007, affected property values of houses in towns along the route, and if they were affected, if it was a positive or negative affect. Using a difference-in-difference model, property values before and after the commuter rail began were compared for houses near and far from the new commuter rail stations. It is hypothesized that properties that are closer to the stop will experience an increase in property values more than properties located farther away. This paper next discusses previous work done on this topic, followed by the data and results. It concludes with a summary of the findings and ideas for future work.

Previous Literature

Public transportation has played a critical role in city development and growth for about a century. Transportation and movement gives consumers more options by allowing them to live in areas different from where they work. Having more options is typically considered a benefit since it does not force consumers to work and reside in the same location. A number of studies have looked at effects of different types of public transportation on property values or rent levels. Many of these studies were done before 2005, when decentralization of cities and suburbanization was very prevalent. In Buffalo, New York, Hess and Almeida (2007) looked at the impact of proximity to light rail rapid transit on station-area property using hedonic models. In this area, where population and ridership is decreasing, they find that every foot closer to a light rail station increases average property values by $2.31. Furthermore, they conclude that the effects are not felt evenly throughout the system, and three independent variables, the number of bathrooms, size of the parcel, and location on the East or West side of Buffalo, are more influential than rail proximity in predicting property values.

Similarly, Bowes and Ihlanfeldt (2001) analyze the impacts of rail transit stations on residential property values, but focus on both positive effects of decreased commuting costs, and negative affects of possible increases in crime rate, due to easier access for criminals. Using a hedonic price model and auxiliary model for neighborhood crime and retail activity, they find that both effects play a role in defining the relationship between property values and rail stations. Additionally, the relative importance of the effects fluctuates with distance from downtown and median income of the neighborhood.

In Washington, DC, Benjamin and Sirmans (1996) analyzed the effects of public transportation options on apartment rents and property values for residential income properties located in close proximity to Metrorail stations. They find that distance from a metro station has an adverse effect on apartment rent, with each one-tenth mile increase in distance from the stations resulting in a decrease rent of about 2.50%. Lastly, Armstrong (1994) analyzed the impacts of commuter rail service as reflected in single-family residential property values near Boston, MA. Looking at both positive and negative influences, he finds an increase in single-family residential property values of approximately 6.7% by virtue of being located within a community having a commuter rail station.

The study presented here is similar to previous work, looking at how proximity to public transportation affects property values, but it differs in that it looks at property values before and after a new commuter rail line was put in, not at property values around a well-established commuter rail facility. Although the values of properties may have changed some before the study time period began, since the construction of the commuter line was expected and visible, this study should still be able to analyze how property values change when new public transportation is put in. The random sorting of houses that are near or far from the commuter rail stops allows for a natural difference – in – difference model, with the start date of the commuter rail being the treatment analyzed.

Data

Archived property valuations are available, but are always a bit subjective to the evaluator. Ideal data for this research would include property values of houses in towns at each stop, with some houses close to the train stop and some far away, and some houses above the median town house price, and some below. The data would also include other information about the house that affects property value, such as age of house, square footage, number of bedrooms and bathrooms, and acres of lot. Ideally, this data would be available for many years before and after the line began, so if could be seen how the property values changed over time.

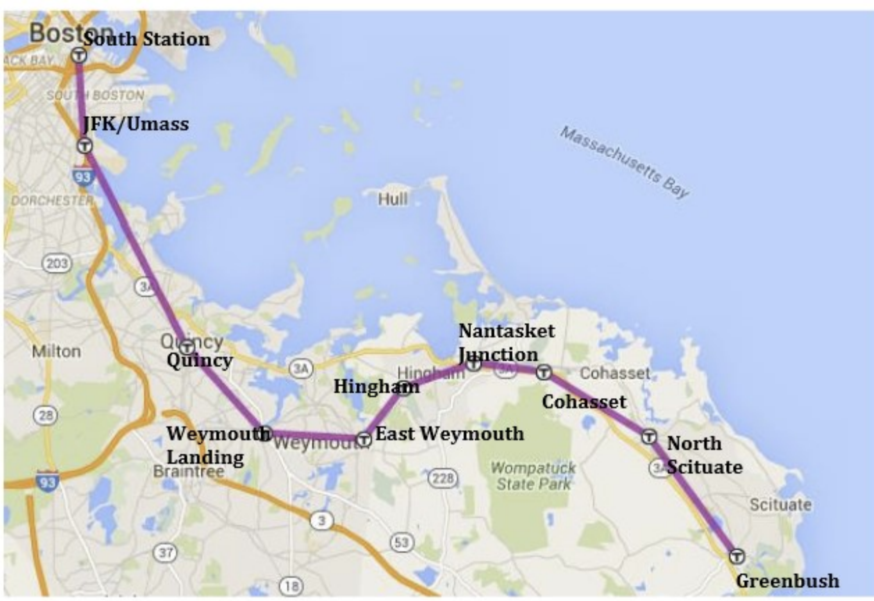

Figure 1: Map of study area: Greenbush Commuter Line route.

The data on all houses has been collected comes from Zillow, a website that helps residents buy, rent and sell homes. For most properties, Zillow has property values every month going back until about 2007. The data consists of 80 total houses, all off the market, looking at the 10 different stops along the route. Figure 1 shows a map of the commuter line route and towns.

8 houses by each stop were chosen. Near each stop, about .1—1.3 miles, 2 houses that have property values just above the town's median 2013 value were chosen, and 2 houses with values just below the 2013 town median. There are then 4 houses that are farther from the stop, about 4-6 miles away, with 2 houses with values just above the 2013 town median and 2 houses with values just below. Median house values by town for 2014 and 2015 were not consistent or seem reliable from a few different sources. Median values from 2013 were consistent from a few different sources. For each house that was chosen, the property value was recorded for the following months: June, September, and November 2007, January and June 2008, Jun 2009, June 2010, June 2011, June 2012, Jun, 3013, June 2014, and the current price (November 2015). For each house, the following information from Zillow and GoogleMaps was recorded: whether it was above the median value or below, whether it was close to the stop or far, the exact distance from the stop, the address, the number of bedrooms, the number of bathroom, and the square footage of the house. Table 1 describes all the variables and their meanings.

Variable Abbreviation	Variable Meaning
Property	ID for each distinct property
time	Month and year the property value was from
dist	Dummy variable, 0 if close to stop, 1 if far
value	Dummy variable, 0 is below town median, 1 if above
squFoot	Square footage of house
bedrooms	Number of bedrooms in house
Bathrooms	Number of bathrooms in house
t	Property value in a given time
stopID	ID for what stop the house is affiliated with
after	Dummy variable: 0 if time is before Oct. 07, 1 if time is after Nov. 07
near	Dummy variable, 0 if close to stop, 1 if far
AN	Interaction of After and Near variables
distTostop	Distance (miles) property is from affiliated stop
distAfter	Interaction of After and distTostop

Table 1: List and description of all variable.

Variable	Observations	Mean	Min	Max
Property	960	40.5	1	80
time	960	6.5	1	12
dist	960	0.55	0	1
value	960	0.5	0	1
squFoot	960	1809.15	728	3722
bedrooms	960	3.08	1	6
bathrooms	960	1.68	1	4
distTostop	960	3.13	0.1	12.6
t	960	430445.1	159000	920520
stopID	960	5.5	1	12
after	960	0.83	0	1
near	960	0.45	0	1
AN	960	0.375	0	1
distAfter	960	2.61	0	12.6

Table 2: Summary statistics for all data.

After the data was input into Excel, it was imported in Stata and reshaped in order for Stata to read it better and analysis to be done. Once the data was configured, it consisted of 960 observations and 14 variables. Table 2 above is a statistical summary of the data. Having data on the value of the properties before 2007 would have strengthened the model. With the construction of the line beginning in 2003, from 2003 to 2007, the line was expected to start and property values could have adjusted some in the anticipation of future benefits. If data was available back to before 2003, the true unexpected property vale change could be analyzed. This data was not available from the property valuation source used. Data were collected as far back it was available, back to June 2007, 4 months before the commuter line opened to the public.

Empirics

A few different models were used to analyze the data. Each model allows the data and analysis to address slightly different questions, but are all related enough that overall they implied the same results.

Model 1

The first model used is a standard OLS model. All the data was used, and the property value of house i in time t was the dependent variable and the general form of the model is:

(1) $$Y_{it} = \beta_0 + \beta_1 S + \beta_2 B + \beta_3 R + \beta_4 D + \varepsilon,$$

where S is the square footage of the house, B is the number of bedrooms, R is the number of bathrooms, and D is the distance in miles to the stop. From this equation we get the coefficient for each explanatory variables, showing how each variable affects the property value of property i in time t.

Model 2

The next model looked at was a difference-in-difference model, using the proximity to the stop as the random division into two groups and the opening of the commuter rail line to the public as the treatment to the near group. All the data was used, and the change in property value for house i in time t is calculated from:

(2) $\delta_{it} = \lambda_0 + \lambda_1 A + \lambda_2 N + \lambda_3 AN + \beta_5 S + \beta_6 B + \beta_7 R + \upsilon$,

where A is a binary variable with 0 before the line started and 1 after, N is a binary variable with 1 close the rail and 0 far, AN is an interaction term of after and near, and the remainder of the variables are the same as in Model 1.

Model 3

The last model was very similar to Model 2, but instead of using the binary variable "near," the continuous variable of distance to the stop was used to interact with the binary variable "after". This would show if the actual distance to the stop had an effect on the property value change, compared to just the general binary variable of it the property is close or far. All the data was used, and the change in property value for house i in time t is calculated from:

(3) $P_{it} = \alpha_0 + \alpha_1 A + \alpha_2 D + \alpha_3 AD + \beta_8 S + \beta_9 B + \beta_{10} R + \mu$,

where A is the binary variable from model 2, D is the distance to the stop, AD is an interaction term of A and D, and the remainder of the variables are the same as in Model 1. The continuous distance variable in this model enables us to see if there are specific property value changes correlated with specific differences, as appose to general property value changes based on if the house is "near" or "far."

Using the three models described above, we used Stata to run the regressions and analyze the data. Starting with model 1, Table 3 shows that all of the variables, distance to the stop, square footage of the house, and number of bedrooms and bathrooms are all statistically significant. The estimated coefficient for the variable distance to the stop is negative and significant at the 1.1% level, with a two-tailed test. As the distance of the property from the commuter rail stop increases by a mile, there is a decrease in property value of $2,230, holding all else constant. Generally, this suggests that there may be a correlation between the proximity to the commuter rail stop and property value. The number of bedrooms, an explanatory, control variable, is statistically significant at just about any significance level, but the estimated coefficient is negative, which is not consistent with the alternative hypotheses. This suggests that as the number of bedrooms increases in a house, the property value decreases. The negative estimated coefficient might be because both square footage and bedrooms are included in the model, and possibly they are correlated in that houses with more square footage always have more bedrooms. This suggests that for a fixed house size, more bedrooms hurt the property value, since the bedrooms would have to be smaller.

	Model 1
distTostop	-2230.25**
	(-875.32)
squFoot	160.21***
	(-5.59)
bedrooms	-25959.92***
	(-3715.39)
bathrooms	81868.05***
	(-5682.85)
n	960
R2	0.8044
Adjusted R2	0.8036
* significant at 10%	
** significant at 5%	
*** significant at 1%	

Table 3: Model 1 Regression Results.

The first model seemed to show a negative relationship between the distance to the commuter rail stop and the property value. Model 2, the difference – in – difference equation, was analyzed next to see if there is a statistically significant difference in the change in property values between the houses that are near the commuter stops and the houses that are far. Seen in Table 4, the variables that were also in model 1, the control variables, are still statistically significant, however the near variable and the interaction term of near and after are not statistically significant. The interaction variable, the variable of interest, is statistically significant at only the 52% level of significance. These results suggest that there is no statistically significant difference between the changes in property values of the near properties compared to the far properties. Property values may have changed due to the new commuter line, but there seems to not be a difference in the change in value whether the house is close to the stop or far. Since model 1 suggested that there was a correlation between proximity to the stop and property value change, but model 2 did not, model 3 was used as a different approach to see if the specific distance to the stop made the change in property value different for near houses compared to far houses.

Model 2	
after	-30064.1***
	(-8932.66)
near	-6689
	(-12158.18)
AN	8562.67
	(-13316.03)
bedrooms	-26118.34***
	(-3700.56)
bathrooms	80611.84***
	(-5640.13)
squFoot	160.14***
	(-5.57)
n	960
R2	0.8064
Adjusted R2	0.8051
* significant at 10%	
** significant at 5%	
*** significant at 1%	

Table 4: Model 2 Regression Results.

The last model analyzed was similar to the difference – in – difference model, but instead of having the interaction term between two binary variables, it was between a binary variable of after and a continuous variable of distance from the stop. Shown in Table 5, these results seem to be consistent with the results from model 2. The explanatory, control variables are still statistically significant, but the interaction term is still not statistically significant. Since the interaction term is not statistically significant, these results also suggest that the change in property values between the near houses and the far house was not statistically different.

Model 3	
after	-20116.96**
	(9776.48)
distTostop	-608.43
	(2106.74)
distAfter	-1946.18
	(2303.13)
bedrooms	-25959.92***
	(3687.54)
bathrooms	81868.05***
	(5640.25)
squFoot	160.21***
	(12814.06)
n	960
R2	0.8078
Adjusted R2	0.8065
* significant at 10%	
** significant at 5%	
*** significant at 1%	

Table 5: Model 3 Regression.

These results are not consistent with the hypotheses, that there would be a negative relation between property value and distance from the commuter rail stop. Although the property values in the town may have changed when the commuter rail started, there is no statistical difference between the changes in property values of the houses near to the stop compared to the prices of houses far from the stop. The addition of the commuter rail brought both benefits and consequence to the towns and to the specific houses. The lack of difference in property value change implies that the benefits and consequences of the commuter rail may have acted to cancel each other out, resulting in an overall no change in property values. The benefits of convenient and reliable public transportation into the city may have been mitigated by the increase noise pollution, congestions, and safety concerns. Another possibility is that the start of the commuter line was expected from the construction and petitions, so the change in property values occurred well before the actually opening of the commuter line to the public. Further research should investigate this potential hypothesis.

A critique of this study would be that some of the towns are quite small and the stops are close together, so a house that was chosen as a far house for one town and stop, could potentially be close to a stop in the neighboring town or another stop in the same town. If this were the case, then the far houses would experience a similar property value change as the near houses, because they also get the benefits of being located close to a stop, but a stop in the neighboring town. If this were true for some of the houses chosen, then both near and far houses would experience property value change, most likely of similar magnitude. This would cause the statistically significant difference in the change of property values that we were looking for to be mitigated, and for there to be no difference in the changes in property values. Since our results showed no statistically significant difference in the changes in property values of near houses and far houses, this critique is possible for our data, and was looked into. Four random houses in the data that were originally thought of as far houses were chosen to test whether they are near a commuter rail stop in a different town. The houses that were chosen were in Quincy, Weymouth, Cohasset, and Scituate.

As seen in table 6, all four houses chosen, that were labeled as far from a commuter rail stop, are located closer to stops in the town either just North or just South of them. Two of the houses, in Quincy and Weymouth, are still 3.7 and 4.3 miles away, which seems far enough that they can still be thought of as "far" from a train stop and may not experience a change in property value as much as the near houses. However, the house that was chosen from Cohasset was a mile closer to the stop in the town just South of it, being only 3 miles away, and the house from Scituate was 3 miles closer to the stop just south of it, being only 1.5 miles away. Both of these distances seem like large enough difference from the original distance that the houses should possibly no longer be considered a "far" house.

Town house is in	Distance to that town stop	Distance to stop North	Distance to stop South
Quincy	4.2	3.7	6.6
Weymouth	4.6	7.6	4.3
Cohasset	4	5.6	3
Scituate	4.5	7.2	1.5

Table 6: Distance (in miles) that four "far" houses are from their associate stop, the next stop just north of them, and the next stop just south of them.

Since half of the randomly chosen houses ended up being located closer to a stop in a town just north or south from then, this suggests that this could be true for other houses in the data set. If this is true for more houses, then the expected difference in property value change between far and near houses would not exists, since the "far" houses would experience the same change in property values from being located close to a stop in a neighboring town. Future research could take the same commuter rail, but instead of selecting houses by tome, simply take each stop and all the towns as region and select near and far houses, making sure the far houses are far from all stops on the commuter line. If this were done, we would expect to see a more significant difference in the change of property value between the near houses and far houses.

Conclusion

This study shows that the benefits and consequence that come from a new public transportation options, specifically the Greenbush commuter rail, may cancel each other out and produce neither net gain or loss from the new public transportation. Although this does not suggest that all public transportation options should be arbitrary or unimportant because there may not be a net gain or loss, it does suggest that in most cases neither the benefits nor the consequences are greatly superior to the other. In all cases of public transportation there will be difference levels of benefits and consequences that mitigate each other to some extent, and each one will be a little different. In some cases there may be more paybacks and in other there may be more costs. However, it seems that in most cases there will not be a clear and evident advantage or disadvantage, with arguments for and against it on both sides. Public transportation options are important for the life and culture of a city, giving residence both a means of transportation and a method of social interaction. When proposing new or alterative public transportation options, all benefits and consequences should be analyzed, but the change in property value should not be scrutinized, since it is often unclear if the advantages or disadvantages are going to have a larger affect, or no affect at all. Future research should look at if certain houses or types of towns are generally affected by public transportation more than others, and how residence reacts to the idea of new public transportation, before and after it is implemented. A change in strength of the public opinion may show how property values will change.

Appendix

Model 1		Model 2		Model 3	
distTostop	-2230.25**	after	-30064.1***	after	-20116.96**
	(-875.32)		(-8932.66)		(9776.48)
squFoot	160.21***	near	-6689	distTostop	-608.43
	(-5.59)		(-12158.18)		(2106.74)
bedrooms	-25959.92***	AN	8562.67	distAfter	-1946.18
	(-3715.39)		(-13316.03)		(2303.13)
bathrooms	81868.05***	bedrooms	-26118.34***	bedrooms	-25959.92***
	(-5682.85)		(-3700.56)		(3687.54)
		bathrooms	80611.84***	bathrooms	81868.05***
			(-5640.13)		(5640.25)
		squFoot	160.14***	squFoot	160.21***
			(-5.57)		(12814.06)
n	960	n	960	n	960
R2	0.8044	R2	0.8064	R2	0.8078
Adjusted R2	0.8036	Adjusted R2	0.8051	Adjusted R2	0.8065
* significant at 10%		* significant at 10%		* significant at 10%	
** significant at 5%		** significant at 5%		** significant at 5%	
*** significant at 1%		*** significant at 1%		*** significant at 1%	

Table 6 Joint data table with all 3 Model for easy comparison of results.

References

Armstrong, Roger J. 1994. "Impacts of Commuter Rail Service as Reflected in Single-Family Residential Property Values." *The National Academies of Sciences, Engineering, Medicine*, 88–98.

Benjamin, John D., and G. Stacy Sirmans. 1996. "Mass Transportation, Apartment Rent and Property Values." *The Journal of Real Estate Research* 12 (1): 1–8.

Bowes, David R., and Keith R. Ihlanfeldt. 2001. "Identifying the Impacts of Rail Transit Statios on Residential Property Values." *Journal of Urban Economics* 50: 1–25.

"Google Maps." 2015. *Google Maps*. Accessed November 23. https://www.google.com/maps.

"Greenbush Line - Wikipedia, the Free Encyclopedia." 2015. Accessed November 23. https://en.wikipedia.org/wiki/Greenbush_Line.

Hess, Daniel Baldwin, and Tangerine Maria Almeida. 2007. "Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, Nw York." *Urban Studies* 44 (5/6): 1041–68.

"MBTA > Schedules & Maps > Commuter Rail > Greenbush Line." 2015. Accessed November 23. http://www.mbta.com/schedules_and_maps/rail/lines/?route=GREENBSH.

"Real Estate, Apartments, Mortgages & Home Values." 2015. *Zillow*. Accessed November 23. http://www.facebook.com/zillow.