Walk-and-Ride:

How MidTOWN DIRECT has affected residential property values within walking distance of train stations

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

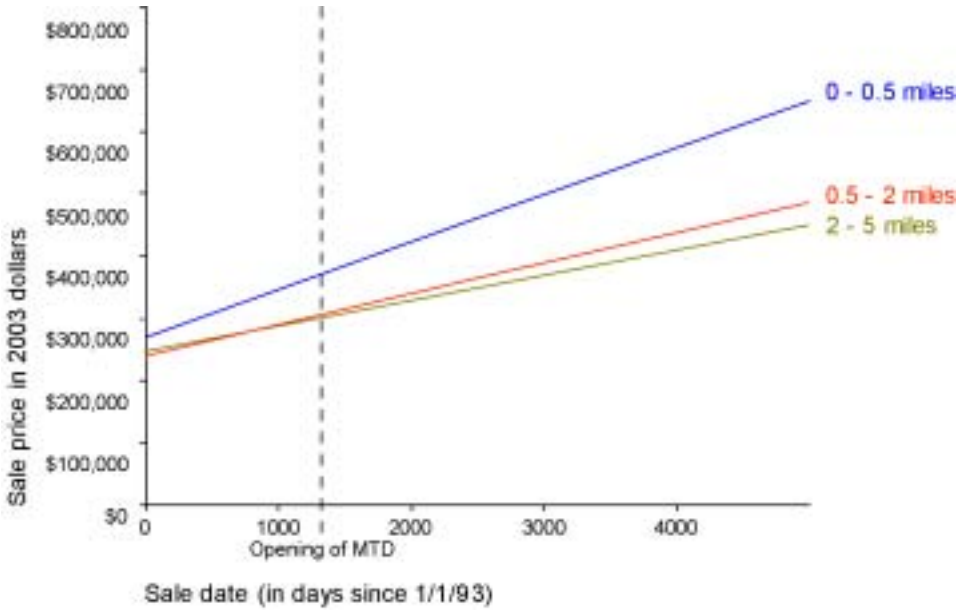
One of NJ TRANSIT's most significant capital improvements in the last decade has been MidTOWN DIRECT service on the Morris & Essex Line. Before MidTOWN DIRECT, Morris & Essex trains terminated in Hoboken, where Manhattan-bound commuters had to transfer to PATH trains to get across the Hudson River. Beginning in 1996, however, some trains were rerouted to terminate in New York's Pennsylvania Station, saving many passengers 20 to 40 minutes in commuting time every day. This study quantitatively evaluates the impact of MidTOWN DIRECT on residential property values within walking distance of twelve study stations between East Orange and Madison.

The Morris & Essex Line

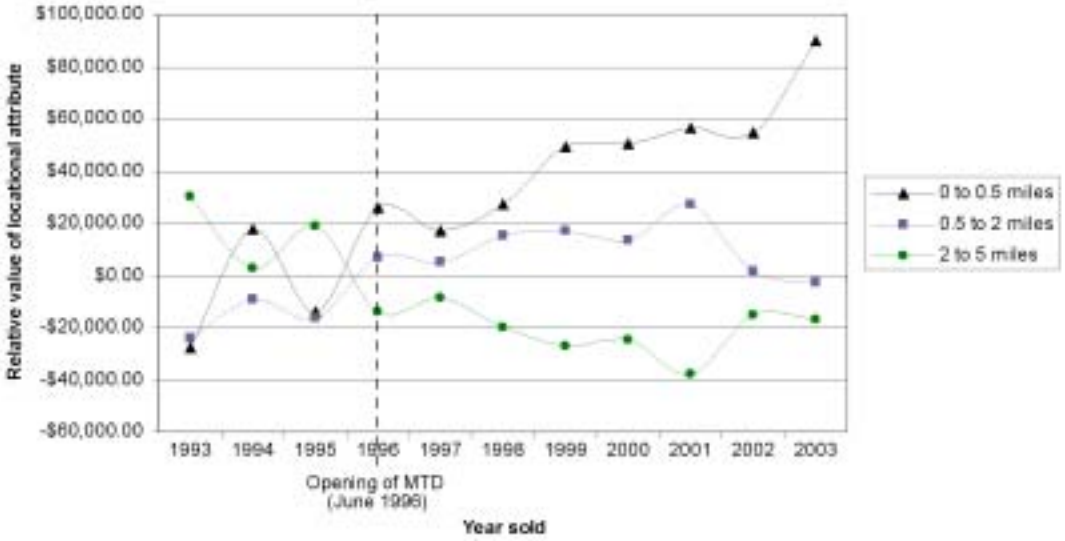
Time-series and hedonic price modeling of 78,000 sales transactions recorded between 1993, three years before MidTOWN DIRECT service began, and 2003 revealed that:

1. Residential properties within one-half mile of all study stations served by MidTOWN DIRECT trains in the AM peak times increased in value by approximately 113 percent between 1993 and 2003 (accounting for inflation). Residential properties located farther

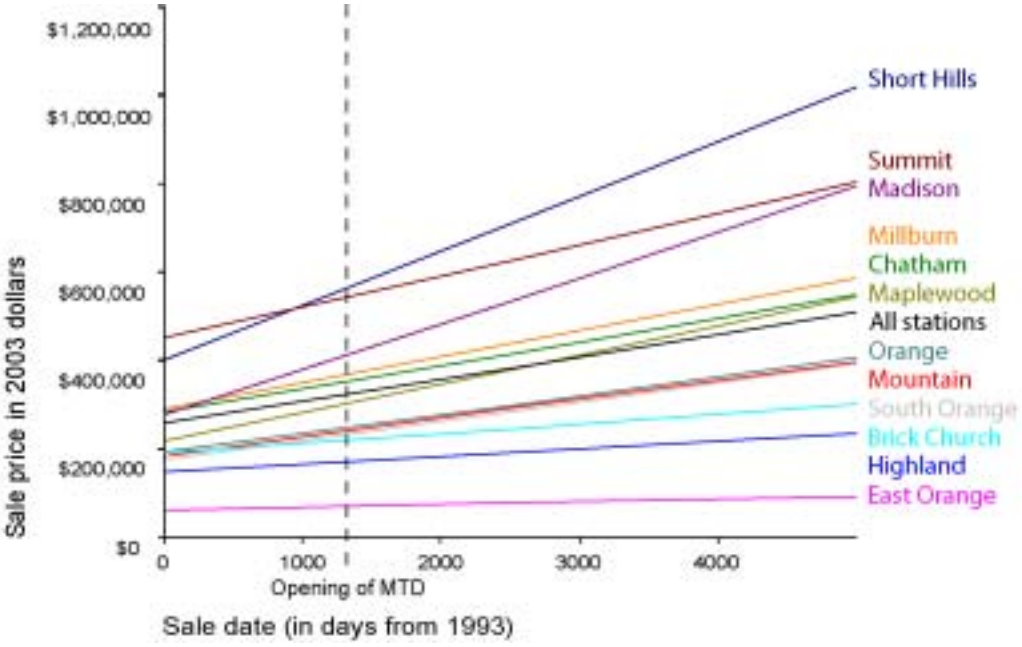
away from MidTOWN DIRECT study stations (between one-half and five miles) experienced an increase of less than 80 percent.



2. Homebuyers paid considerably more to be within walking distance of stations with MidTOWN DIRECT service in 2003 than they did eleven years earlier. In 1993, on an average property sale price of $337,238 (in 2003 dollars), the relative value of being within walking distance to stations, compared to other property attributes such as number of rooms and school quality, was -$28,045; in 2003, it was $89,965 on an average property sale price of $447,313. By contrast, the relative value of being two to five miles from these stations decreased significantly in the same time period: from $30,112 in 1993 to -$17,268 in 2003.



3. The area within one-half mile of some stations gained in value more than areas around other stations. Properties near the Madison, Maplewood, South Orange and Short Hills stations increased in value by more than 100 percent between 1993 and 2003 (in 2003 dollars). Around the East Orange, Brick Church and Highland stations, by contrast, properties increased in value by less than 50 percent. One possible reason for such a discrepancy is uneven MidTOWN DIRECT service: the towns with more frequent service in the AM peak fared consistently better than those with little or no MidTOWN DIRECT service.



The findings of this thesis illustrate that NJ TRANSIT's investments in MidTOWN DIRECT were well spent: the service had an immediate and desirable impact on real estate values and economic development near stations, and further improvements should be pursued. This thesis also shows that there is a strong market for housing within walking distance of stations. Developers, as well as municipal, county and state governments should ensure that this demand leads to the construction of mid-dense, mixed-use development that encourages residents to walk and ride the train.

I. INTRODUCTION

In the last twenty years, NJ TRANSIT has spent more than $7.5 billion to repair, rehabilitate, expand, and connect all of New Jersey's passenger lines, built in the late 1800s by competing rail companies, into one seamless transit system. This major commitment to rail marks a fundamental shift away from decades of investment in highways and cars (State of New Jersey and NJ TRANSIT 1999). One of NJ TRANSIT's most significant capital improvements has been MidTOWN DIRECT service on the Morris & Essex Line. Before MidTOWN DIRECT, Morris & Essex trains terminated in Hoboken, where Manhattan-bound commuters had to transfer to PATH trains to get across the Hudson River. Beginning in June 1996, however, some Morris & Essex Line trains were rerouted to terminate in New York's Pennsylvania Station, saving most commuters twenty to 40 minutes in commuting time every day.

History has shown that new or significantly improved transportation infrastructure, such as a highway or a rail line, can change land use patterns and guide urban growth. It was, and continues to be, the hope of NJ TRANSIT and the State of New Jersey that MidTOWN DIRECT will help not only revitalize older urban and suburban areas along the Morris & Essex Line, but also change land use patterns and reduce sprawl by concentrating growth in existing suburbs. MidTOWN DIRECT service began eight years ago – too little time for significant amounts of new development to have taken place around MidTOWN DIRECT stations. It is not too early, however, to evaluate whether property values have increased near train stations. Such an evaluation is useful because property value increases generally occur quickly and they are a good indicator of future new development. This thesis aims to measure the impact that MidTOWN DIRECT has had on residential property values within walking distance, defined as one-half mile, of Morris & Essex Line stations with MidTOWN DIRECT service. The findings of this research will help inform towns as they develop smart growth plans for the future of their community.

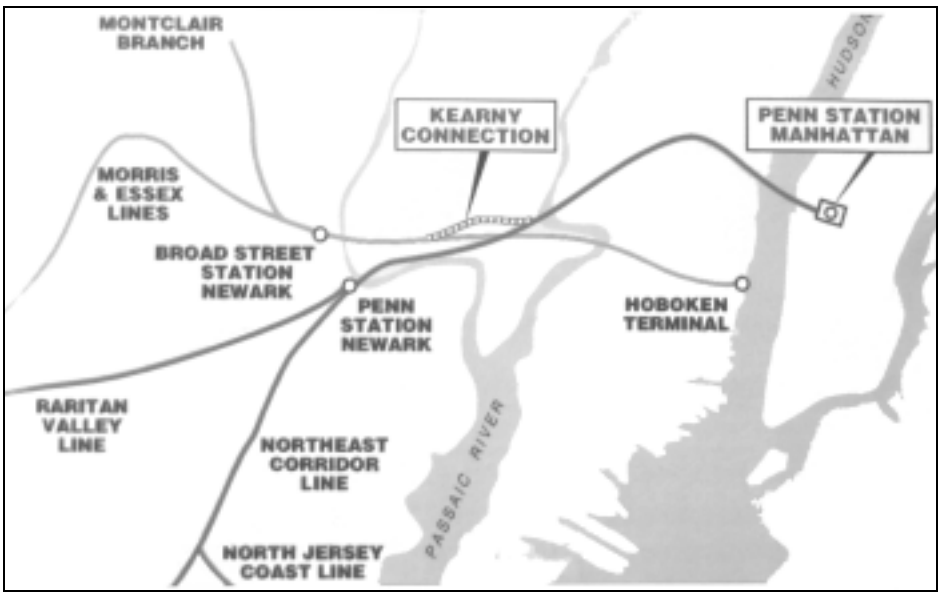
The Morris & Essex Line and MidTOWN DIRECT

The Morris & Essex Line is composed of the Morristown main line and the Gladstone branch line, which meet in Summit. The Morris & Essex Line includes 33 stations and

serves mainly as a commuter line for residents of Essex, Union, Morris, Somerset and Warren counties who work in Newark or Manhattan. The line has two terminal rail stations: Hoboken and, since June 1996, Pennsylvania Station in midtown Manhattan.

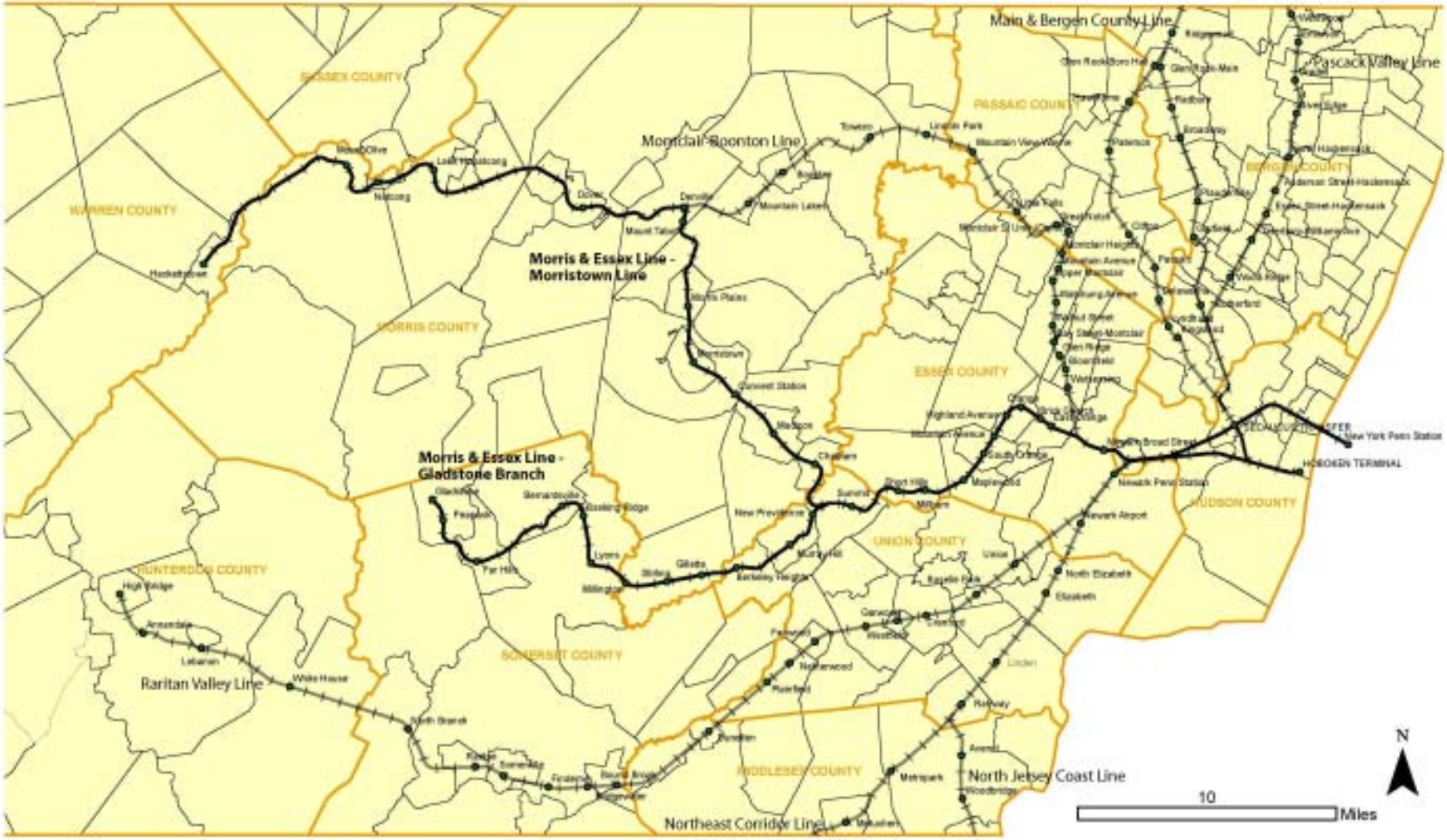
The idea of rerouting Morris & Essex trains onto Northeast Corridor tracks was not new: The "Kearny Connection," as it was known, was originally proposed in the mid-1960s. It was not until NJ TRANSIT assumed operation of all commuter rail service in New Jersey in 1983, however, that the idea was seriously pursued. By then, commuter traffic across the Hudson River – both by transit and by car – was heavy and rapidly increasing (Moore, Kelly et al. 1997). In 1988, NJ TRANSIT formally proposed the project. It was stalled for several years for lack of funds (Gilbert 1993), but construction finally began in 1993. In all, five miles of new track, a 350-foot long bridge, and 35 new track switches were constructed, and modifications were made to the locomotives and track system (Moore and Kelly 1996). The $69 million project, financed entirely with state funds, opened on June 10, 1996 (Garbarine 1996).

The Kearny Connection



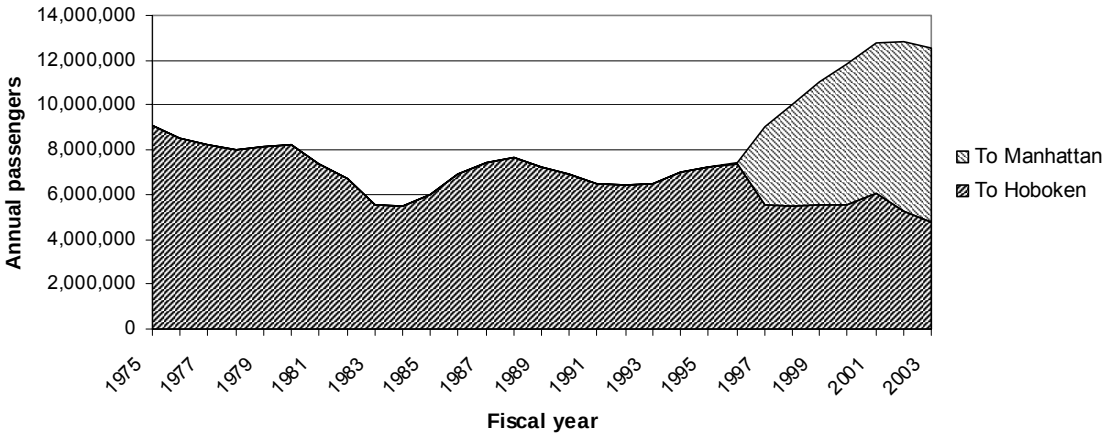
Source: (Moore and Kelly 1996)

The Morris & Essex Line



In terms of ridership, MidTOWN DIRECT service has exceeded all expectations. Annual Morris & Essex Line ridership rates, which had hovered between 5.5 million and 8 million since 1981, quickly increased to reach nearly 13 million in 2002. In 2003, MidTOWN DIRECT ridership reached 7 million (for more information about ridership, refer to Appendix C).

Annual Ridership Data, Morris & Essex Line



Source: NJ TRANSIT

The East Orange to Madison corridor: yesterday and today

The history of the towns along the Morris & Essex Line is inextricably linked to the railroad. The Oranges, Maplewood, Millburn, Summit, the Chathams, Madison and Morristown all owe their beginnings to the Erie Lackawanna freight and long-distance passenger railroads built in the 19th century. The railroad first attracted industry, which in turn attracted immigrants and other blue-collar workers. Then, wealthy businessmen and financiers from Newark and New York began to use the rail lines for daily transport. They figured out that they could continue to run their factories or businesses in Newark or Manhattan while living in large estates in the countryside, away from the dirt and congestion of the city. Thus were born some of the nation's first railroad suburbs. In fact, according to Alan Karcher, former Speaker of the New Jersey State Assembly, the City of Orange was America's very first railroad suburb (Karcher 1998). South Orange, Summit, Morristown soon followed Orange's lead, attracting Newark's and New York's upper social and economic classes (Jackson 1985).

The heyday of these railroad suburbs ended with the heyday of the railroads. After World War II, when trucks and automobiles began to compete with rail freight shipping and passenger travel, rail revenues decreased rapidly. The Erie Lackawanna Railroad went into bankruptcy in 1976. The New Jersey Department of Transportation continued to operate the Morris & Essex Line as a commuter passenger line, but ridership remained stagnant. Even though the population of New Jersey was increasing rapidly, these newcomers were moving farther out, into areas not served by rail. The once-thriving downtowns around Morris & Essex train stations were left largely abandoned.

Since it was announced that MidTOWN DIRECT service would begin in 1996, this trend has been reversed. The string of towns along the Morris & Essex Line has experienced an unprecedented boost in real estate values in the last ten years. The prospect of a one-seat, fast ride to midtown Manhattan persuaded many homebuyers to give a fresh look at West Orange, Summit, South Orange, Maplewood and Morristown. A NJ TRANSIT survey conducted just five months after MidTOWN DIRECT service began found that thousands of people moved to the Morris & Essex Line corridor because of MidTOWN DIRECT (Marchwinski 1998). Although quantifying the exact impact of the new train service on real estate values is difficult, it is clear that the property values in towns along the Morris & Essex Line have grown much more than in the region as a whole (Garbarine 1996; McDowell 2000; Daigle 2002; Holusha 2002).

Jans Wells, a Rutgers University expert on housing and transportation, suggests another factor contributing to the revival of New Jersey's inner suburbs: a change in demographics. Increasing numbers of suburban residents are childless couples, professionals and aging baby boomers, who do not want single-family homes but prefer denser residential construction – townhouses or apartments – near train stations. Even though developers still have concerns about investing in urban areas, such as crime, property values and poverty, they are now beginning to look at redeveloping inner-city areas to meet that population's housing demand (Anonymous 2004). In the mid-1990s, as more people moved into these long-neglected inner suburbs, these areas gained in reputation and attractiveness, drawing even more new residents and businesses. As South Orange's Jacqueline Herships put it, "Word of mouth has helped change neighborhoods that were rundown and totally undervalued for 30 years after the Newark riots into lovely, thriving neighborhoods" (Martin 2002).

Scope of this study

There is plenty of anecdotal evidence that MidTOWN DIRECT has increased the value of property in the towns that it serves. This thesis does not aim to measure the total impact of MidTOWN DIRECT on property values in the region. Rather, this thesis concerns itself with the value that homebuyers place on being within walking distance of a station with good MidTOWN DIRECT service.

This thesis is organized into five sections. Chapter II reviews the literature that addresses the relationship between transit infrastructure and real estate values, on a theoretical and an empirical level. Chapter III explains the theoretical framework and methodology for this study, and Chapter IV presents this study's results. Chapter V discusses the planning implications of the research findings. Chapter VI concludes this thesis and suggests areas for further research.

II. REVIEW OF THE EXISTING LITERATURE

Rail transit and real estate values: Theoretical claims

In theory, proximity to light-rail or heavy-rail transit stations may have positive or negative impacts on residential property values. On one hand, improved access to the region's commercial center reduces transportation costs – in terms of either money or time – thereby increasing the amount of money available for living expenses. All else being equal, activities should shift toward rail station areas, and this should translate into increased property values (Huang 1996).

On the other hand, rail stations often come with noise, congestion, vibration, pollution and visual impacts that can reduce sales values for nearby properties. Furthermore, some argue that improved accessibility does not, in fact, concentrate growth, but disperses it. Meyer and Gómez-Ibáñez suggest that improved rail lines or highways may disperse growth because faster, more convenient transportation allows commuters to move farther out from the CBD without increasing overall travel time (Meyer and Gómez-Ibáñez 1981). In addition, it could be argued that in most urban areas, where there is a dense network of highways and roads and where a large proportion of workers do not

commute to “downtown,” new rail lines represent only a marginal improvement in overall transportation accessibility. In this environment, rail improvements may lead to only marginal increases in real estate values (Huang 1996).

Empirical claims

Most empirical studies find that access to rail transit has a positive impact on property values, especially within close proximity to the stations. In 1995, John Landis and Robert Cervero found that houses immediately adjacent to San Francisco’s BART sold for nearly 38 percent more than identical houses in areas not served by BART (Landis and Cervero 1995). In a separate study, Cervero found that BART also increased rent values. The rent premium for being within one-quarter mile of a station was $34 a month (Cervero 1996).

Two studies conducted sixteen years apart each revealed that proximity to the Washington, DC, Metro had positive impacts on property values and rents. In 1980, just a few years after the transit system opened, houses near stations increased in value by 6 to 13 percent for every 100 meters (320 feet) closer to the Metro station that a house was located (Lerman, Damm et al. 1980). In 1996, Benjamin and Sirmans documented the fact that residential rents decreased by 2.4 percent for every one-tenth mile increase from Metro stations (Benjamin and Sirmans 1996).

In an extensive study of the Philadelphia region’s SEPTA and PATCO heavy rail lines in 1991, Voith found that “premiums associated with accessibility to train service… average $5,594 or 6.4 percent of average house value” (Voith 1991). This study backs another study conducted in 1987 by the Joint Center for Urban Mobility Research, which found that the PATCO Lindenwold Line increased the value of nearby houses by 7 percent, or $4,500 on average (Joint Center for Urban Mobility Research 1987).

Other studies have found that proximity to the rail station may cause both positive and negative impacts concurrently. Al-Mosaind et al., for instance, found that in Portland, Ore., although residential property values increased if they were located within one-third mile of MAX light-rail stations, they decreased if they were located directly adjacent to the station (Al-Mosaind, Duecker et al. 1993). In other studies, the impacts of heavy rail

stations on property values varied by the neighborhood. In Atlanta, for instance, rail stations did not increase sales values in poor neighborhoods because the rail line there was perceived as a nuisance. In rich neighborhoods, by contrast, the stations did add values to residential properties, presumably because the added accessibility compensated for the station's nuisance effects (Nelson 1992). Similarly, Gatzlaff and Smith found that the slight increase in sales values of single-family homes near Miami's Metrorail varied by neighborhood: Metrorail weakly increased the value of properties near stations in higher priced neighborhoods, but did not benefit properties in neighborhoods experiencing decline (Gatzlaff and Smith 1993).

Unresolved issues

In this era of renewed interest in public transit, studies about the impacts of rail on property values and land use are critical. It is particularly important to examine these impacts in the New York region given that the tri-state area leads the nation in transit ridership. In 2002, the most recent year for which data is available, nearly 60 percent of all rail passenger trips in the United States were traveled in the New York tri-state region. New York's Metropolitan Transit Authority and New Jersey's NJ TRANSIT are the first and third largest transit agencies in the U.S., respectively. The behavior of these agencies, therefore, has significant impacts on nationwide trends in transit investment and land use impacts.

Unlinked rail passenger trips, FY2002 (in thousands)

	Nationwide	New York Region		
		Total	Per system	
Commuter rail	414,163.9	237,976.2	64,342.2	NJ TRANSIT (heavy rail)
			100,504.0	MTA Long Island Railroad
			73,130.0	MTA Metro-North
Heavy rail	2,687,973.0	1,760,284.2	1,694,026.6	MTA New York City Transit
			3,618.4	MTA Staten Island Railway
			62,639.2	Port Authority Trans Hudson
Light rail	336,531.0	7,760.1	7,760.1	NJ TRANSIT (light rail)
Total	**3,024,504.0**	**1,768,044.3**		
NY share		**58.46%**		

Source: (American Public Transportation Administration 2004)

III. THEORETICAL FRAMEWORK AND METHODOLOGY

Theoretical framework

This thesis attempts to shed light on how NJ TRANSIT's significant investments in rail transportation have impacted residential property sales values, particularly within walking distance of stations. Specifically, this thesis will address three separate questions. First, did the value of properties within walking distance of stations with MidTOWN DIRECT service increase more than properties located farther away? Second, has property location become a more important factor in determining residential property values since 1993? All else being equal, what do people pay for a residence within walking distance, close driving distance and far driving distance of a train station? Third, did property values increase equally around all twelve study stations, or did properties near stations with better MidTOWN DIRECT service do better than properties near stations with little or no MidTOWN DIRECT?

Study area

The study area is defined as follows:

- The line chosen is the Morris & Essex Line because, even though all of NJ TRANSIT lines in northern New Jersey have been significantly improved in recent years, MidTOWN DIRECT on the Morris & Essex Line was the first of these projects to be completed, in 1996. (MidTOWN DIRECT on the Montclair Branch opened in 2002 and Secaucus Junction in 2003). The experience of the Morris & Essex Line can help inform what will happen along NJ TRANSIT's other lines that have been improved recently.

- The stations studied are twelve consecutive stations from East Orange to Madison (in order, from New York, they are: East Orange, Brick Church, Orange, Highland, Mountain Avenue, South Orange, Maplewood, Millburn, Short Hills, Summit, Chatham and Madison). East Orange was chosen as the eastern-most station in this study because it is the first station on the Morris & Essex Line not served by other NJ TRANSIT lines. Madison was chosen as the western-most station in this study because it was important that all stations be consecutive, and there were data collection problems around Convent Station, the station just west of Madison. As illustrated in the table below, Madison Station is well within the 86-minute travel-time boundary beyond which,

according to NJ TRANSIT research, no trips are induced by MidTOWN DIRECT service (Marchwinski 1998). It is important to note that MidTOWN DIRECT trains do not stop at three of the twelve stations studied here: East Orange, Mountain and Highland Avenue. These stations are not included in parts 1 and 2 of the study because, even though passengers can board Hoboken-bound trains and change to Penn Station-bound trains at a later station, they do not have a one-seat ride to New York, a major feature of MidTOWN DIRECT service. These three stations, however, are included in part 3 of this study.

Train service in the AM peak period (defined as arriving into New York Penn Station or World Trade Center via PATH on weekdays between 7AM and 9AM)

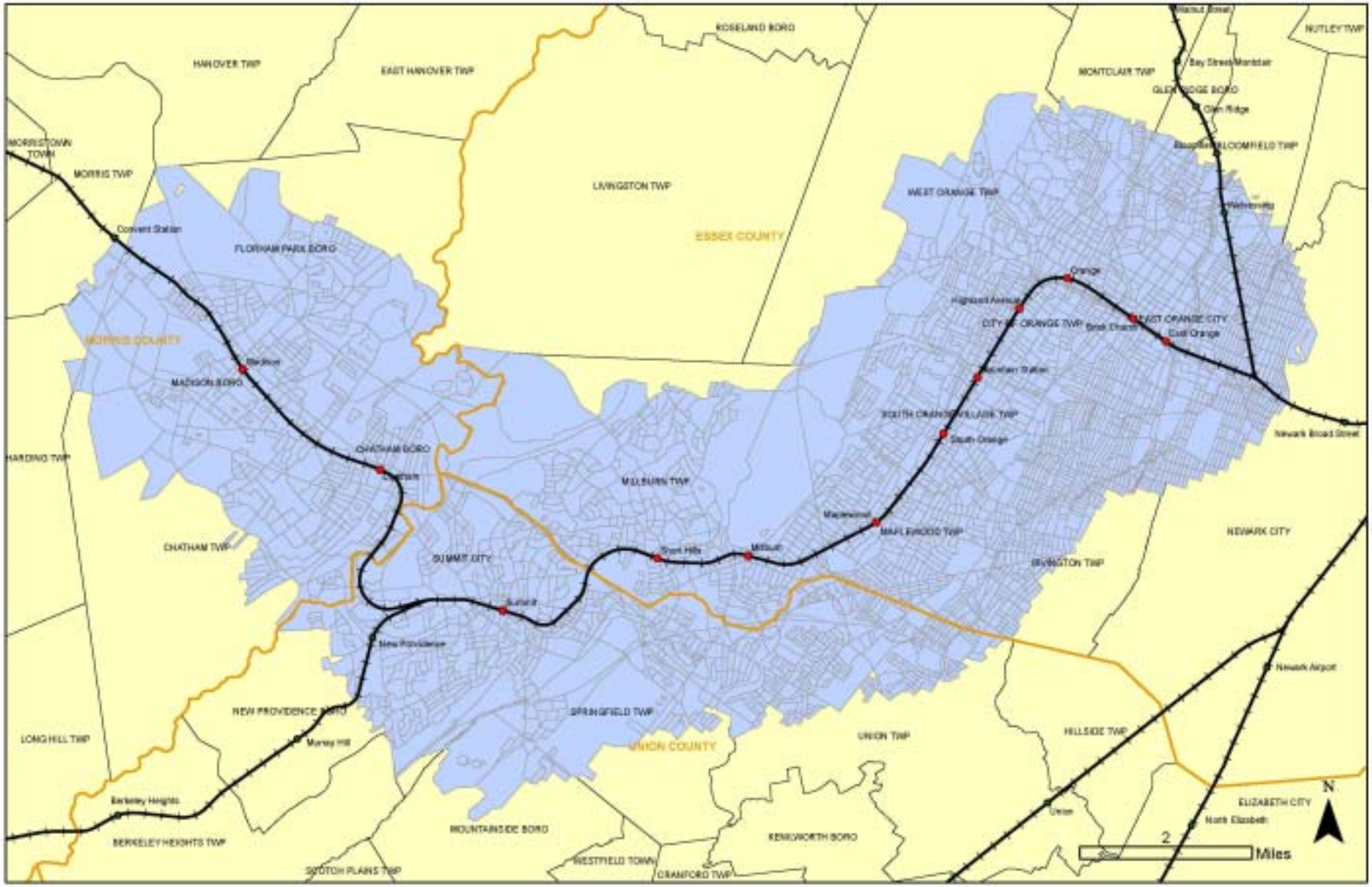
	Number of MidTOWN DIRECT trains	Number of Hoboken-bound trains	Avg travel time to Manhattan, in minutes
Madison	5	4	62
Chatham	5	4	59
Summit	6	9	54
Short Hills	3	5	51
Millburn	3	5	48
Maplewood	3	5	47
South Orange	4	5	49
Mountain	0	4	52
Highland	0	4	50
Orange	1	4	44
Brick Church	3	4	38
East Orange	0	4	44

Source: NJ TRANSIT

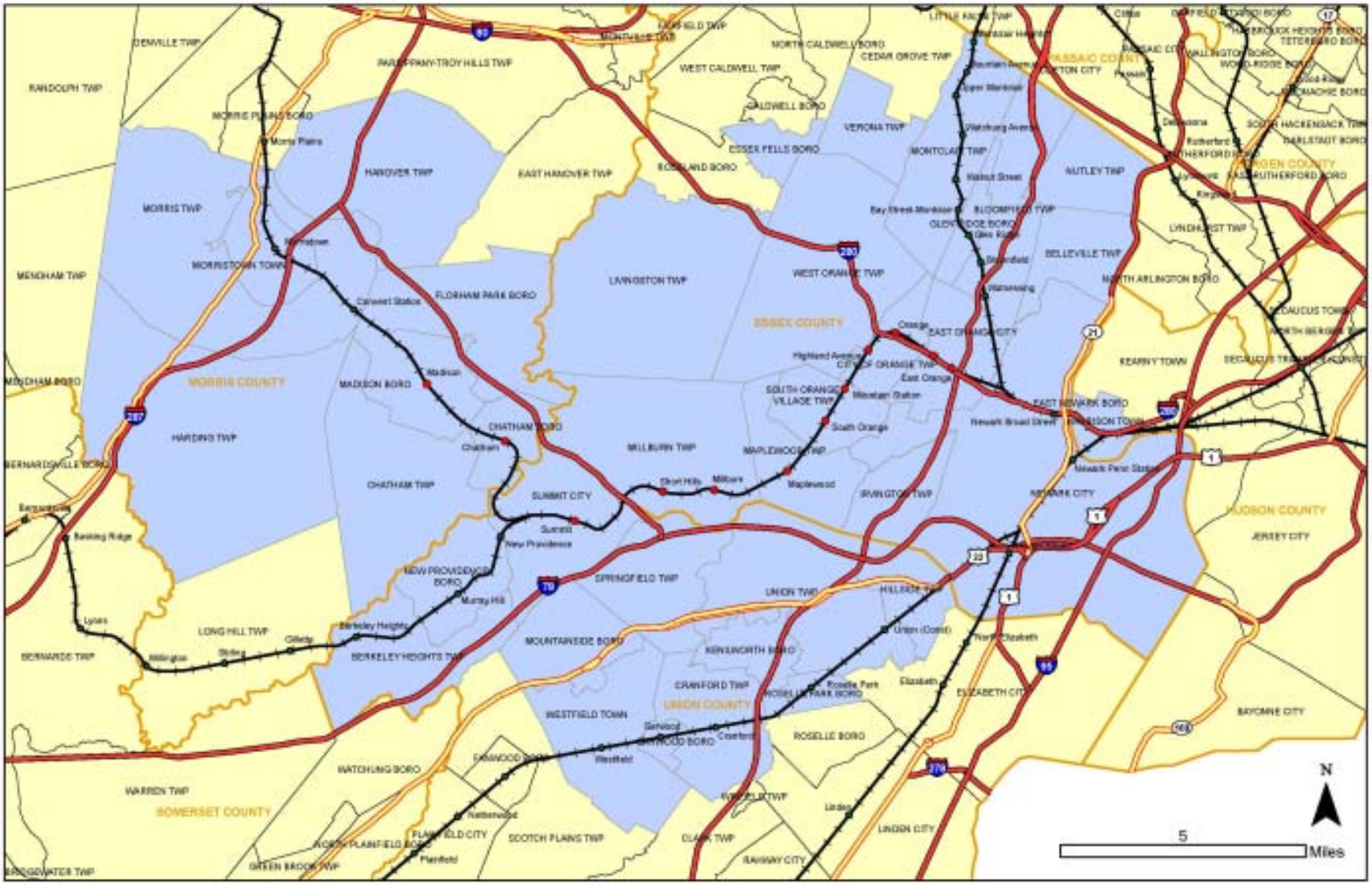
- The area considered is that of all towns whose center is within five miles of the twelve train stations (See Appendix A). This total area is further broken down into “within walking distance” areas, which includes all tax blocks whose center is located within one-half mile of study stations (Marchwinski 1998), and “within short driving distance” areas, which includes all tax blocks whose center is located within two miles of study stations, but not within one-half mile of study stations. The distance of two miles was chosen based on a NJ TRANSIT survey conducted in November 1996, which shows that nearly four in five people who board the train at the twelve study stations between 6 and 9AM come from less than two miles away (NJ TRANSIT 1996). For more information about key findings of this survey, please refer to Appendix D.

Blocks in half-mile study area

Blocks in two-mile study area



Towns in five-mile study area



- The time period studied is January 1, 1993 to December 31, 2003. The year 1993, three years before MidTOWN DIRECT service began in June 1996, is the first year for which electronic sales data was consistently collected by the Garden State Multiple Listing Service. The year 2003 is the last whole year for which the data has been compiled in its entirety.

Model and variable specification

The widely accepted method of determining property values is the use of multivariate regression analysis to estimate a hedonic price index from house prices. This index is derived from the premise that the price of a house represents the value of a set of characteristics and services. If these attributes can be produced in various combinations, the value of each independent attribute can be estimated. Using multiple regression, real estate values are apportioned among various explanatory variables, such as property size and style, school quality and accessibility (Cervero and Duncan 2002). The sum of these attribute values is the value of the property itself (Dewees 1974).

The general multiple regression model is:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k + \varepsilon ,$$

where Y is the dependent variable (such as the property value), and X_k are the independent or explanatory variables (such as the size of the property, the date the property was purchased, or its proximity to a rail station). The term α is constant, while the coefficients β_k measure the changes in Y associated with a unit change in X_k on the assumption that all other values for the remaining explanatory variables are held constant. Finally, ε is an error term (Pindyck and Rubinfield 1981).

This study considers many explanatory variables of different types. Some variables describe the physical structure of the property sold; other variables describe the community in which the property is located; other variables provide information about the location of the property with regard to rail stations; and other variables describe the sale date and price of the property.

Specifically, structural attribute variables include:

- ROOMS: the number of rooms in the residence
- BEDS: the number of bedrooms in the residence
- BATHS: the number of full bathrooms in the residence
- OLDHOUSE: dummy variable: if the residence was built before 1930, value is 1; if not, value is 0
- NEWHOUSE: dummy variable: if the residence was built 10 years or less before it was sold, value is 1; if not, value is 0
- BESTSTYL: dummy variable: if the residence is a Colonial-, Victorian- or Tudor-style residence (the most highly valued residence styles in the region), value is 1; if not, value is 0

Municipality attribute variables include:

- SCHLSCOR: combined language/arts and mathematics proficiency score of the zoned high school, by municipality
- PERCWHIT: percentage of municipality's residents who are white
- PERCOWNR: percentage of municipality's residents who own their home
- MEDINCM: median household income in the municipality
- PGROWTH: percentage by which the municipality's population increased from 1990 to 2000
- TAXRATE: residential property tax rate at time of sale

Locational attribute variables include:

- WALKALL: dummy variable: if the property is on block whose center is located within 0.5 miles of any of the twelve study stations (direct line), value is 1; if not, value is 0
- WALKMTD: dummy variable: if the property is on block whose center is located within 0.5 miles of any of the nine study stations with MidTOWN DIRECT service (direct line), value is 1; if not, value is 0
- MTD_.5_2: dummy variable: if the property is on block whose center is located between 0.5 miles and 2 miles of any of the nine MidTOWN DIRECT station (direct line), value is 1; if not, value is 0
- MTD_2_5: dummy variable: if the property is in a town whose center is located less than 5 miles from any of the nine MidTOWN DIRECT stations (direct line) and if it is

located on a block whose center is located more than 2 miles from those stations, value is 1; if not, value is 0

Market attribute variable includes:

- SALEDATE: number of days since January 1, 1993, that the property sale transaction was completed
- SALEPRIC: raw sale price of the property
- SP2003: property sale price, adjusted for inflation to 2003 dollars, using the official Consumer Price Index (Oregon State University 2003)

Between January 1, 1993 and December 31, 2003 in the 39 towns studied, 76,668 residential sales transactions were recorded by realtors in the Garden State Multiple Listing Service. About a third of these sales transactions, however, were missing one or more key variable data, such as the sale date and price, or the number of rooms, age and architectural style of the property improvement, or the rate at which the property was taxed at time of sale. Because multivariate regression analysis requires that all of these attribute data be present in all cases, only the sales transactions that were not missing any of these variable data – 49,834 sales transactions in all – were included in Models 1 and 2 of this study. All sales transactions recorded for properties within one-half mile of stations – 5,540 in all – were used in Model 3.

IV. RESULTS & INTERPRETATION

Initial bivariate correlation tests found that the ROOMS, BEDS, BATHFULL variables were too highly inter-correlated (their r square was greater that 0.6) to all be included in the final model, so ROOMS alone was selected. This was also the case for the SCHLSCOR, PERCWHIT, PERCOWNR and MEDINCM variables, and SCHLSCOR alone was selected. The correlation between WALKALL and WALKMTD was also high, but these two variables were not used in the same model at the same time.

Question 1: Did residential properties within walking distance of stations with MidTOWN DIRECT service increase in value more than properties farther away?

Answering Question 1 requires the use of a two-variable linear regression model to create a trendline, or best-fit line, estimating the overall increase in property value from 1993 to 2003, first within walking distance (one-half mile) of MidTOWN DIRECT stations, then within short driving distance (one-half to two miles), then within far driving distance (two to five miles) of MidTOWN DIRECT stations. As previously stated, only nine of the twelve study stations have MidTOWN DIRECT service in the morning AM peak: Brick Church, Orange, South Orange, Maplewood, Millburn, Short Hills, Summit, Chatham and Madison.

Regression

To measure the amount by which property values increased within each distance category, variations on the same time-series model were run. Equation 1a considers the sale of all properties on blocks whose center is located within one-half mile of a station served by MidTOWN DIRECT. Equation 1b considers properties located one-half to two miles away from these stations. Equation 1c considers properties located two to five miles away from these stations. In all of these equations, the independent variable is the date that the property was sold, and the dependent variable is the sale price adjusted for inflation.

The three time-series regression models used are specified below:

Equation 1a: $SP2003_{WALKMTD} = \alpha + \beta\ (SALEDATE_{WALKMTD}) + \varepsilon$

Equation 1b: $SP2003_{MTD\_.5\_2} = \alpha + \beta\ (SALEDATE_{MTD\_.5\_2}) + \varepsilon$

Equation 1c: $SP2003_{MTD\_2\_5} = \alpha + \beta\ (SALEDATE_{MTD\_2\_5}) + \varepsilon$

It is expected that, in all three equations, SALEDATE will have a positive β coefficient, as property values have increased beyond inflation in the area overall. Of particular interest to this study is whether this coefficient is the strongest in Model 1a, which would mean that properties within walking distance of MidTOWN DIRECT stations have experienced a greater increase in value than properties farther out.

Results

The regression equations came out as follows:

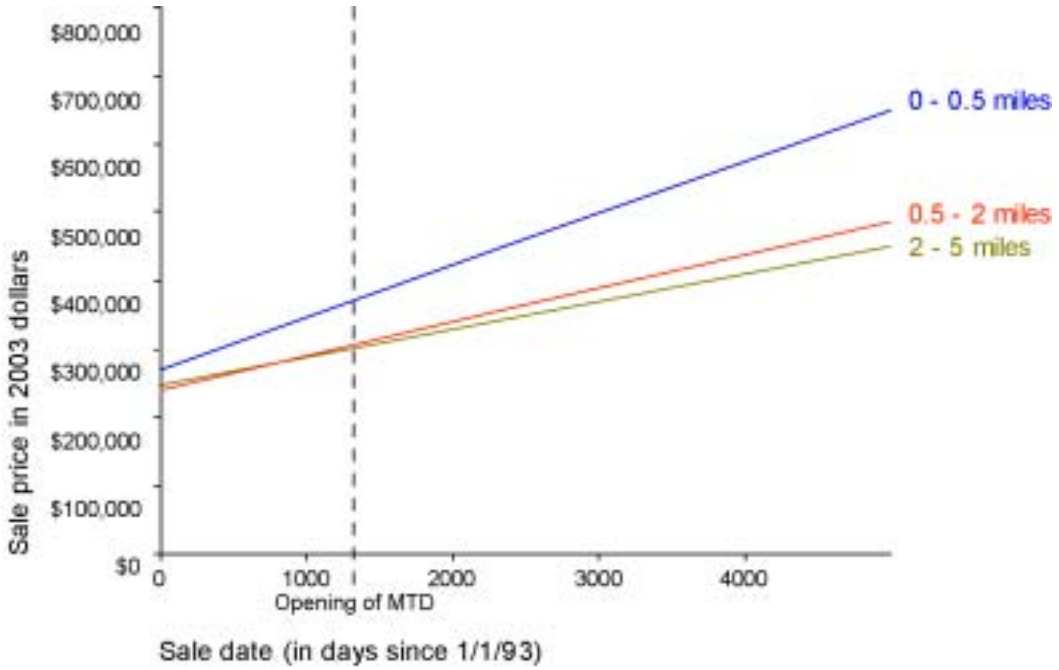
Equation 1a: $SP2003_{WALKMTD} = \$270{,}440 + 75.86\ (SALEDATE_{WALKMTD}) \pm \$13{,}918$

Equation 1b: $SP2003_{MTD\_.5\_2} = \$241{,}986 + 49.15\ (SALEDATE_{MTD\_.5\_2}) \pm \$6{,}412$

Equation 1c: $SP2003_{MTD\_2\_5} = \$249{,}539 + 40.5\ (SALEDATE_{MTD\_2\_5}) \pm \$4{,}073$

Results were statistically significant at the 0.001 level in all three equations.

Time-series best-fit lines for each distance category



See Appendix F for all scatter plots and best-fit lines.

Interpretation

The coefficients above reveal the average rates of increase in value of properties (in addition to inflation) sold between 1993 and 2003. For instance, Equation 1a tells us that for all properties within walking distance of MidTOWN DIRECT stations, the mean, regressed property sale price on January 1, 1993, was $270,440 (in 2003 dollars). This mean sale price increased, on average, $75.86 a day until December 31, 2003. Similarly, we can say that in the area one-half to two miles away from stations served by MidTOWN DIRECT, the mean property sale price was $241,986 at the beginning of 1993 and increased, on average, $49.15 a day until the end of 2003. Finally, the

regression shows that the mean regressed sale price of properties located two to five miles away from MidTOWN DIRECT station increased $40.50 a day starting at $249,539 from early 1993 to late 2003.

	Mean regressed property value on 1/1/93 (in 2003 $)	Mean property value increase per day, 93-03	Days between 1/1/93 and 12/31/03	Mean regr. property value on 12/31/2003	Property value increase, 93-03
WALKMTD	$270,440	$75.86	4017	$575,170	112.68%
MTD_.5_2	$241,986	$49.15	4017	$439,422	81.59%
MTD_2_5	$249,539	$40.50	4017	$412,228	65.20%

Overall, properties within one-half mile of stations with MidTOWN DIRECT service increased in value by 113 percent between 1993 and 2003. By contrast, properties within close- and far-driving distance increased by only 82 percent and 65 percent, respectively.

Question 2: Has proximity to MidTOWN DIRECT stations become a more important factor in determining residential property values?

Having demonstrated that properties within walking distances appreciated in value more than properties located farther away, it is now important to examine whether this increase is attributable to the properties' location, or whether other factors were also significant. It may be, for instance, that properties within walking distance of stations increased in value because they happen to be largely Victorian in style, and Victorian-style houses became popular in the 1990s – not because of any change in train service.

To calculate the impact of one property attribute compared to other attributes, we use multivariate regression analysis as described in the Model Specification section above. Model 2 attempts to assess, year to year, the impact of properties' locational attributes on properties' sale price, holding constant the impact of several other property attributes, such as the number of rooms and the building's age. All else being equal, in 1993, how much did homebuyers pay to be located within walking distance of a station that would later be served by MidTOWN DIRECT? How much did they pay for this same locational feature in later years, after MidTOWN DIRECT began operation?

Regression

To calculate the impact of properties' locational attributes, year by year, each of the three dummy variables (WALKMTD, MTD_.5_2 and MTD_2_5) was tested in separate regression equations. Since there are three distance variables and eleven study years, Model 2 includes 33 equations:

Equation 2a:

$$SP2003_{1993} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (WALKMTD) + \varepsilon$$

Equation 2b:

$$SP2003_{1994} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (WALKMTD) + \varepsilon$$

…

Equation 2l:

$$SP2003_{1993} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (MDT\_.5\_2) + \varepsilon$$

Equation 2m:

$$SP2003_{1994} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (MDT\_.5\_2) + \varepsilon$$

…

Equation 2w:

$$SP2003_{1993} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (MDT\_2\_5) + \varepsilon$$

Equation 2x:

$$SP2003_{1994} = \alpha + \beta_1 (ROOMS) + \beta_2 (OLDHOUSE) + \beta_3 (NEWHOUSE) + \beta_4 (BESTSTYL) + \beta_5 (SCHLSCOR) + \beta_6 (PGROWTH) + \beta_7 (TAXRATE) + \beta_8 (SALEDATE) + \beta_9 (MDT\_2\_5) + \varepsilon$$

It is expected that structural and community attributes will remain relatively stable in all equations. Locational variables, however, should vary from year to year. It is anticipated that the relative value of living within walking distance increased from 1993 to 2003, as people gradually understood the convenience and affordability of living near train stations – therefore that the WALKMTD coefficients will increase from 1993 to 2003. The relative value of living within short driving distance (one-half to two miles) and far driving distance (two to five miles) is expected to remain stable or decrease.

Results

For the sake of simplicity, only locational variable coefficients are included here. Results from all 33 regression equations are included in Appendix E.

Relative value of the three locational variables, by year

Sale year	Mean property sale price in 1993 (in 2003 $)	β (WALK MTD)	Sig.	β (MTD _.5_2)	Sig.	β (MTD _2_5)	Sig.
1993	$337,238.45	-$28,044.60	*	-$24,167.67	***	$30,111.69	***
1994	$325,518.37	$17,739.03		-$9,180.68		$2,887.42	
1995	$317,564.34	-$13,937.93		-$16,214.11	**	$19,093.99	**
1996	$313,019.52	$26,085.07	**	$6,959.28		-$14,121.52	**
1997	$292,755.01	$17,093.49	*	$4,882.21		-$8,804.40	**
1998	$307,794.37	$26,885.21	**	$15,286.47	***	-$20,181.96	***
1999	$324,487.96	$48,993.55	***	$16,791.26	***	-$26,867.56	***
2000	$358,059.90	$50,731.12	***	$13,319.26	**	-$24,872.20	***
2001	$386,462.13	$56,159.77	***	$27,037.76	***	-$38,089.13	***
2002	$427,846.93	$54,737.35	***	$1,610.18		-$15,281.42	**
2003	$447,313.01	$89,965.47	***	-$2,979.30		-$17,267.63	***

*** indicates significance at the 0.01 level
** indicates significance at the 0.05 level
* indicates significance at the 0.1 level

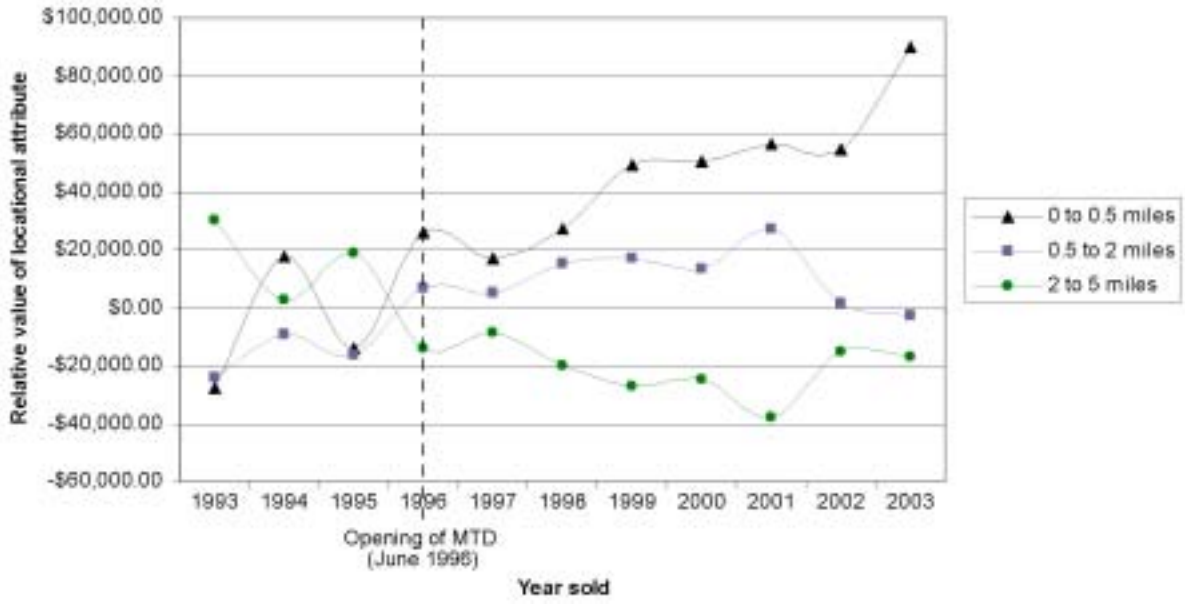
Interpretation

As the β coefficients above make clear, the relative value of the WALKMTD variable went from being negative, in 1993, to strongly positive, after MidTOWN DIRECT service began. On the mean property sale price of $337,238 in 1993 (adjusted to 2003 dollars), for instance, the value of being located within walking distance of a station that would,

three years later, get MidTOWN DIRECT was -$28,045, all else being equal. In other words, the location of a property near a train station reduced the value of the property by approximately $28,000. By 2003, on the mean property sale price of $447,313, the value of the same location attribute had increased to +$89,965.

The relative value of MTD_2_5, by contrast, went from being strongly positive at $30,112 on an average sale price of $337,238 in 1993, to negative after MidTOWN DIRECT service began in 1996. In 2003, all else being equal, the value of being two to five miles away from a MidTOWN DIRECT station was -$17,268 on a mean property sale price of $447,313. The relative value of MTD_.5_2 is more difficult to assess because it was statistically insignificant for several years. The years that were significant seem to indicate that MidTOWN DIRECT service did add value to the attribute of being located between one-half mile and two miles from MidTOWN DIRECT stations after the service began, but not nearly as much as the WALKMTD variable.

Relative value of locational attribute on an average-priced property (in 2003 dollars)



Homebuyers paid considerably more to be within walking distance of stations with MidTOWN DIRECT service in 2003 than they did eleven years earlier. By contrast, the relative value of being two to five miles from these stations decreased significantly in the same time period.

Question 3: Have properties within walking distance of some stations increased in value more than properties around other stations?

Question 3 aims to calculate how property values have changed in the areas within walking distance of each of the twelve study stations. The model used here is the same as the one used in Question 1. It is a simple, two-variable linear regression model to create a trendline, or best-fit line, estimating the overall increase in value for properties within walking distance of stations, from 1993 to 2003. A separate equation is run for each of the twelve study stations (including the three stations that receive no MidTOWN DIRECT service in the AM peak period).

Regression

The time-series regression models used are specified below:

Equation 3a: $SP2003_{AllStations} = \alpha + \beta\ (SALEDATE_{AllStations}) + \varepsilon$

Equation 3b: $SP2003_{Madison} = \alpha + \beta\ (SALEDATE_{Madison}) + \varepsilon$

Equation 3c: $SP2003_{Chatham} = \alpha + \beta\ (SALEDATE_{Chatham}) + \varepsilon$

Equation 3d: $SP2003_{Summit} = \alpha + \beta\ (SALEDATE_{Summit}) + \varepsilon$

Equation 3e: $SP2003_{ShortHills} = \alpha + \beta\ (SALEDATE_{ShortHills}) + \varepsilon$

Equation 3f: $SP2003_{Millburn} = \alpha + \beta\ (SALEDATE_{Millburn}) + \varepsilon$

Equation 3g: $SP2003_{Maplewood} = \alpha + \beta\ (SALEDATE_{Maplewood}) + \varepsilon$

Equation 3h: $SP2003_{SouthOrange} = \alpha + \beta\ (SALEDATE_{SouthOrange}) + \varepsilon$

Equation 3i: $SP2003_{Mountain} = \alpha + \beta\ (SALEDATE_{Mountain}) + \varepsilon$

Equation 3j: $SP2003_{Highland} = \alpha + \beta\ (SALEDATE_{Highland}) + \varepsilon$

Equation 3k: $SP2003_{Orange} = \alpha + \beta\ (SALEDATE_{Orange}) + \varepsilon$

Equation 3l: $SP2003_{BrickChurch} = \alpha + \beta\ (SALEDATE_{BrickChurch}) + \varepsilon$

Equation 3m: $SP2003_{EastOrange} = \alpha + \beta\ (SALEDATE_{EastOrange}) + \varepsilon$

It is expected that property values have increased around most, if not all, train stations from 1993 to 2003, and therefore that SALEDATE will have a positive β coefficient in most, if not all equations. It is also expected, however, that the β coefficient of SALEDATE will be stronger in some equations than others. Specifically, we anticipate finding that station areas with little or no MidTOWN DIRECT service did not see property values increase as much as station areas with better MidTOWN DIRECT service.

Results

The equation coefficients are specified below:

Equation 3a: $SP2003_{AllStations} = \$257,440 + 50.24\ (SALEDATE_{AllStations}) \pm \$7,890$

Equation 3b: $SP2003_{Madison} = \$276,854 + 103.87\ (SALEDATE_{Madison}) \pm \$32,559$

Equation 3c: $SP2003_{Chatham} = \$282,206 + 53.20\ (SALEDATE_{Chatham}) \pm \$9,196$

Equation 3d: $SP2003_{Summit} = \$450,592 + 70.73\ (SALEDATE_{Summit}) \pm \$62,198$

Equation 3e: $SP2003_{ShortHills} = \$398,121 + 123.55\ (SALEDATE_{ShortHills}) \pm \$31,658$

Equation 3f: $SP2003_{Millburn} = \$290,977 + 59\ (SALEDATE_{Millburn}) \pm \$16,392$

Equation 3g: $SP2003_{Maplewood} = \$215,363 + 65.26\ (SALEDATE_{Maplewood}) \pm \$11,330$

Equation 3h: $SP2003_{SouthOrange} = \$176,675 + 43.99\ (SALEDATE_{SouthOrange}) \pm \$10,699$

Equation 3i: $SP2003_{Mountain} = \$186,300 + 42.87\ (SALEDATE_{Mountain}) \pm \$15,365$

Equation 3j: $SP2003_{Highland} = \$147,176 + 17.23\ (SALEDATE_{Highland}) \pm \$10,042$

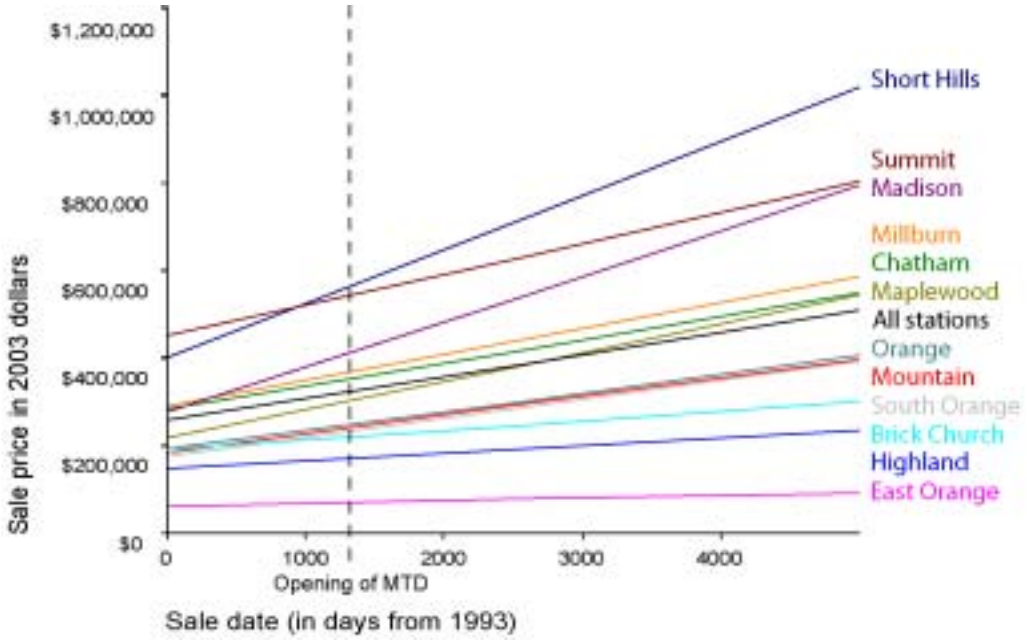
Equation 3k: $SP2003_{Orange} = \$188,925 + 42.14\ (SALEDATE_{Orange}) \pm \$18,775$

Equation 3l: $SP2003_{BrickChurch} = \$191,261 + 21.56\ (SALEDATE_{BrickChurch}) \pm \$31,842$

Equation 3m: $SP2003_{EastOrange} = \$62,781 + 5.7\ (SALEDATE_{EastOrange}) \pm \$10,484$

Results were statistically significant at the 0.01 level in all equations, except for Brick Church and East Orange, which were significant at the 0.1 and 0.15 level, respectively.

Best-fit lines for each station area



For all scatter plots and best-fit lines, please refer to Appendix G.

Interpretation

As in Model 1, the coefficients in Model 3 reveal the average rates of increase in value of properties (accounting for inflation) that are located within one-half mile of train stations and were sold between 1993 and 2003. For instance, Equation 3a reveals that for all properties within one-half mile of all twelve study stations, the mean, regressed sale price of a residential property on January 1, 1993 of $257,440 (in 2003 dollars) increased, on average, $50.24 a day until December 31, 2003. Similarly, we can say that in the area within walking distance of Brick Church, the mean property sale price was $191,261 at the beginning of 1993 and increased, on average, $21.56 a day until the end of 2003.

	Mean regressed property value on 1/1/93 (in 2003 $)	Mean property value increase per day, 93-03	Days between 1/1/93 and 12/31/03	Mean property value on 12/31/2003	Property value increase, 93-03
All stations	$257,440	50.24	4017	$459,254	78.39%
Madison	$276,854	103.87	4017	$694,099	150.71%
Chatham	$282,206	53.2	4017	$495,910	75.73%
Summit	$450,592	70.73	4017	$734,714	63.06%
Short Hills	$398,121	123.55	4017	$894,421	124.66%
Millburn	$290,977	59	4017	$527,980	81.45%
Maplewood	$215,363	65.26	4017	$477,512	121.72%
South Orange	$176,675	43.99	4017	$353,382	100.02%
Mountain	$186,300	42.87	4017	$358,508	92.44%
Highland	$147,176	17.23	4017	$216,388	47.03%
Orange	$188,925	42.14	4017	$358,201	89.60%
Brick Church	$191,261	21.56	4017	$277,867	45.28%
East Orange	$62,781	5.7	4017	$85,677	36.47%

As the coefficients and graphs above make clear, some station areas saw their property values increase much more than others. Properties near the Madison, Maplewood, South Orange and Short Hills stations increased in value by more than 100 percent between 1993 and 2003. Around the East Orange, Brick Church and Highland stations, by contrast, properties increased in value by less than 50 percent in those eleven years.

A subject for further inquiry is the determination of what factors contributed to such a discrepancy in property value appreciation from station to station. At first glance, the frequency of MidTOWN DIRECT service seems a possible factor, as towns with more frequent service in the AM peak fared consistently better than those with little or no MidTOWN DIRECT service. However, according to former NJ TRANSIT officials Stan

Rosenblum and Martin Robins, the decision about how much MidTOWN DIRECT service each station would get was based entirely on previous ridership and through-put. So inner-city suburbs like the Oranges, with low household incomes, high minority-population rates and low commuting rates to New York, were largely bypassed by MidTOWN DIRECT. By contrast, suburban towns farther out, with higher rates of middle- and upper-class white population who commuted to Manhattan got more frequent MidTOWN DIRECT service (Robins 2004; Rosenblum 2004). Thus MidTOWN DIRECT service is closely correlated with pre-1996 ridership – and therefore demographic – data, and both have had a direct impact on property value increases.

Station-area property value increases (daily) compared with MidTOWN DIRECT service

Station	β (SALE DATE)	Nb MTD trains, AM peak
East Orange	5.70	0
Highland	17.23	0
Brick Church	21.56	3
Orange	42.14	1
Mountain	42.87	0
South Orange	43.99	3
Chatham	53.20	5
Millburn	59.00	3
Maplewood	65.26	3
Summit	70.73	6
Madison	103.87	5
Short Hills	123.55	3

Limitations

Although this study casts some light on the critical question of how rail transit affects property values, it suffers from some limitations. These limitations include problems with hedonic price modeling itself, with the quality and quantity of data used, and with the specificity of the housing market under consideration.

The first limitation of this study is inherent to hedonic price modeling itself, since it assumes that homebuyers have the opportunity to select any combination of property attributes. In reality, however, only a selected number of properties are on the market at any given time, and homebuyers never really make choices between an infinite variability of properties.

A second shortfall of this study concerns the availability of certain property sales data. Two significant pieces of information were missing from the analysis. Square footage, which is proven to be a more reliable indicator of property sales value than the number of rooms, was inconsistently reported by realtors in the Garden State Multiple Listing Service database and was therefore excluded from the study, and replaced with the less reliable “ROOMS” proxy. Also not reflected in this study was properties’ accessibility by other means of transportation, like car, bus or train on another line. The models would have been more accurate if they had included data on properties’ distance to the nearest highway exit, commuter bus, or train station on a different rail line. Finally, because multiple regression analysis requires that each case considered has data on all variables, approximately one-third of the 78,668 property sales transactions listed in the Garden State Multiple Listing Service had to be excluded from Models 1 and 2. This would not be a problem if the listings eliminated were a random sample of those entered in the database. It is likely, however, that the excluded cases were not evenly distributed throughout the region, thereby slightly skewing this study’s sample population of sales. All of these limitations in the data, however, are in part compensated for by the extremely large number of sales transactions included in the study.

Another shortfall in the data used is that, while the property variables (such as sale price, house age, and proximity to stations) were specific to each property, census data variables (such as community growth, median income, and school quality) were constant by municipality throughout the entire study period. It would have been preferable to use yearly data by census block or tract. The reason for this lack of precision is that while property sales data was tracked by tax block by the Garden State Multiple Listing Service, census data was available by census block, and by decade. Matching up the two block systems and finding out census data by year would have been extremely time-consuming. However, a more detailed analysis with more precise census data – both in time and space – would be invaluable to determining more exactly the impact of MidTOWN DIRECT on property values.

A third reservation with this study has to do with attributing all the increase in property value in proximity to MidTOWN DIRECT stations to the train service. MidTOWN DIRECT certainly provided the initial boost, but as the station areas grow to accommodate new

residences, movie theaters, and restaurants, they eventually become more desirable places to live regardless of the station and train line themselves.

The last major limitation to this study concerns its applicability to other urban areas in the United States. Northern New Jersey is a unique housing market, as it is suburban to New York, the nation's largest city. The region is both extremely dense and fast-growing. How rail service improvements would impact residential property markets in mid-sized cities or suburban areas that are experiencing lower levels of housing demand is difficult to predict from this research.

V. Planning Implications and Conclusions

MidTOWN DIRECT on the Morris & Essex Line has positively impacted the entire string of towns from East Orange to Madison. Not only has the service made commuting to New York easier and faster, but it has also significantly revitalized urban areas that were old and largely neglected. This thesis has found that the impact of MidTOWN DIRECT on residential property values was most strongly felt within walking distance of the train stations. From 1993 to 2003, properties within one-half mile of stations with MidTOWN DIRECT service saw their values increase by 113 percent (above inflation), compared to less than 82 percent for properties located farther away. This study has also found that a property's location became an increasingly important factor in determining its overall value. While, in 1993, homebuyers paid a premium for a house more than two miles away from stations, by 2003, homebuyers paid an even larger premium for the property to be less than one-half mile from MidTOWN DIRECT stations.

The effect of MidTOWN DIRECT service, however, has not been uniform from station to station. Some station areas, like Madison, Short Hills and Maplewood, have seen their property values increase by more than 120 percent (above inflation) from 1993 to 2003, while others, like Highland, Brick Church and East Orange, experienced increases of less than 50 percent. At first glance, property value increases seemed closely related to the frequency of MidTOWN DIRECT service at the station. Further research should be conducted to determine precisely why some stations fared better than others.

Overall, the findings of this thesis point to three main policy recommendations. First, this thesis shows that New Jersey residents greatly value living near stations with good MidTOWN DIRECT service. Homebuyers pay tens of thousands of dollars for a home from which they are able to walk and ride directly to New York. Older suburbs that had been largely overlooked for 30 years have been significantly revitalized. The return on New Jersey's $69 million investment has been remarkable. Both for quality-of-life improvements and economic development, the state should continue to aggressively invest in its rail infrastructure and service provision.

Second, NJ TRANSIT should reconsider its policy of providing MidTOWN DIRECT service to particular stations based on 1996 ridership demand. That policy was developed at a time when the land use effects of rail transit were less clear than they are today. Now that we understand the very strong positive impact that MidTOWN DIRECT has had on property values particularly in proximity to stations with frequent service, we know that the Highland, Mountain, Orange and East Orange station areas would experience a major boost in property values if NJ TRANSIT invested in more frequent MidTOWN DIRECT service at those stations.

The third recommendation that this paper supports is the active encouragement of the construction of mid-dense, mixed-use, pedestrian areas centered around train stations. This thesis has shown that there is a strong market for housing within walking distance of Morris & Essex Line stations. Whether such a demand leads to the actual construction of townhouses and apartment buildings, however, is uncertain. Study after study has shown that further steps need to be taken to ensure that development takes place around stations (Corbett 1996; Huang 1996; Bernick and Cervero 1997; Kreyling 2001; Isaacs 2002). First, private developers, who have so far considered mixed-use, mid-density suburban development around train stations untested and therefore risky, must be made aware of studies such as this one, that prove strong market demand for transit-accessible housing. Second, towns' zoning ordinances must be amended to not only allow for this type of development, but encourage it with beneficial regulatory structures, generous financing schemes and/or the provision of large, profitable lots. Regionally, the state should enact policies that attract both residents and businesses to urban areas, particularly those served by transit. Every new resident or business close to a train station is a potential transit user, and every transit user increases the efficiency of the

transit system. It is in New Jersey's and NJ TRANSIT's best interest to respond to the demand for transit-accessible housing that this study has revealed, and actively promote transit-friendly development in the region.

APPENDIX A: TOWNS IN STUDY AREA

Belleville Township
Berkeley Heights Township
Bloomfield Township
Chatham Borough
Chatham Township
Cranford Township
East Newark Borough
East Orange City
Essex Fells Township
Florham Park Borough
Garwood Borough
Glen Ridge Township
Hanover Township
Harding Township
Harrison Town
Hillside Township
Irvington Township
Kearny Town
Kenilworth Borough
Livingston Township
Madison Borough
Maplewood Township
Millburn Short Hills
Montclair Township
Morris Township
Morristown Town
Mountainside Borough
New Providence Borough
Newark City
North Arlington Borough
Nutley Township
Orange City
South Orange Village
Springfield Township
Summit City
Union Township
Verona Township
West Orange Township
Westfield Town

APPENDIX B: DATA SOURCES

Garden State Multiple Listing Service sales records:

- ROOMS: the number of rooms in the residence
- OLDHOUSE: dummy variable: if the house was built before 1930, value is 1; if not, value is 0
- NEWHOUSE: dummy variable: if the house was built 10 years or less before it was sold, value is 1; if not, value is 0
- BESTSTYL: dummy variable: if the residence is a Colonial-, Victorian- or Tudor-style residence (the most highly valued residence styles) , value is 1; if not, value is 0
- SALEPRIC: the sale value of a property
- SALEDATE: day, month and year the sale transaction was completed
- TAXRATE: current residential property tax rate

United States Census 1990 and 2000:

- PGROWTH: percentage by which the municipality's population increased from 1990 to 2000
- PERCWHITE: percentage of municipality's residents who are white
- PERCOWNR: percentage of municipality's residents who own their home
- MEDINCM: median household income in the municipality

New Jersey Department of Education:

- SCHLSCOR: combined language/arts and mathematics proficiency score of the zoned high school, by municipality

APPENDIX C: MORRIS & ESSEX LINE RIDERSHIP DATA

Annual ridership on the Morris & Essex Line

FY	Trains to Hoboken	MidTOWN DIRECT	Total
1975	9,085,287		9,085,287
1976	8,481,379		8,481,379
1977	8,192,206		8,192,206
1978	8,045,496		8,045,496
1979	8,173,912		8,173,912
1980	8,200,203		8,200,203
1981	7,356,409		7,356,409
1982	6,744,001		6,744,001
1983	5,561,638		5,561,638
1984	5,473,392		5,473,392
1985	5,988,289		5,988,289
1986	6,929,119		6,929,119
1987	7,437,948		7,437,948
1988	7,613,937		7,613,937
1989	7,249,973		7,249,973
1990	6,963,476		6,963,476
1991	6,529,790		6,529,790
1992	6,428,923		6,428,923
1993	6,512,606		6,512,606
1994	6,991,200		6,991,200
1995	7,198,700		7,198,700
1996	7,343,663	63,384	7,407,047
1997	5,563,893	3,447,625	9,011,518
1998	5,465,742	4,577,800	10,043,542
1999	5,566,982	5,491,033	11,058,015
2000	5,553,489	6,246,271	11,799,760
2001	6,042,136	6,736,026	12,778,162
2002	5,261,408	7,552,612	12,814,020
2003	4,741,236	7,779,426	12,520,662

Source: NJ TRANSIT

Average weekday passenger boardings, 2003

Madison	1194
Chatham	1196
Summit	2860
Short Hills	1186
Millburn	1291
Maplewood	2297
South Orange	2291
Mountain	360
Highland	337
Orange	665
Brick Church	1218
East Orange	362

Source: NJ TRANSIT

APPENDIX D: NJ TRANSIT SURVEY, KEY FINDINGS

This survey was conducted by NJ TRANSIT in November 1996. Included here are key findings for the twelve study stations.

Question: How did you get to the train station?

	Nb. of respondents	Came by car		Walked	
Madison	692	569	82.3%	117	16.9%
Chatham	757	501	66.1%	243	32.0%
Summit	1,419	977	68.8%	400	28.2%
Short Hills	737	435	59.1%	294	39.9%
Millburn	630	465	73.8%	157	24.9%
Maplewood	1,195	755	63.2%	416	34.8%
South Orange	942	508	54.0%	402	42.7%
Mountain	263	138	52.4%	123	46.9%
Highland	77	14	18.2%	62	81.2%
Orange	209	165	79.2%	32	15.1%
Brick Church	266	147	55.1%	84	31.6%
East Orange	46	28	61.3%	18	38.7%
Total	7,232	4,702	**65.0%**	2,347	**32.5%**

Source: (NJ TRANSIT 1996)

Question: From how far away did you start your trip today?

	Came from 0 to 0.5 miles away		Came from 0.5 to 2 miles away	
Madison	133	19.2%	368	53.22%
Chatham	207	27.3%	392	51.71%
Summit	326	22.9%	1,070	75.38%
Short Hills	366	49.6%	286	38.79%
Millburn	196	31.1%	266	42.13%
Maplewood	398	33.3%	666	55.76%
South Orange	368	39.0%	456	48.39%
Mountain	144	54.7%	79	30.12%
Highland	52	67.3%	14	18.09%
Orange	56	27.0%	79	37.67%
Brick Church	118	44.5%	92	34.39%
East Orange	16	34.3%	16	34.42%
Total	2,379	**32.9%**	3,782	**52.29%**

Source: (NJ TRANSIT 1996)

Question: Did you move because of MidTOWN DIRECT?

	Moved because of MidTOWN DIRECT	
Madison	26	3.8%
Chatham	49	6.5%
Summit	102	7.2%
Short Hills	33	4.4%
Millburn	39	6.2%
Maplewood	79	6.7%
South Orange	70	7.5%
Mountain	7	2.6%
Highland	6	7.2%
Orange	19	9.1%
Brick Church	2	0.9%
East Orange	3	6.2%
Total	435	**6.0%**

Source: (NJ TRANSIT 1996)

APPENDIX E: RESULTS – COEFFICIENTS

In the following tables, " *** " indicates significance at the 0.01 level, " ** " indicates significance at the 0.05 level, and " * " indicates significance at the 0.1 level.

Question 1

$SP2003_{distance} = \alpha + \beta\ (SALEDATE_{distance}) + \varepsilon$

Value of SALEDATE attribute, 0 to 0.5 miles from MidTOWN DIRECT stations

Observations	2,767
R square	0.07
Adjusted R square	0.07
Standard error of the estimate	305,575.83
F-ratio	194.60
t-ratio	19.43

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	270,440.00	13,918.20		19.431	0.000	***
SALEDATE	75.86	5.44	0.256	13.950	0.000	***

Value of SALEDATE attribute, 0.5 to 2 miles from MidTOWN DIRECT stations

Observations	13,448
R square	0.03
Adjusted R square	0.03
Standard error of the estimate	287,486.45
F-ratio	406.56
t-ratio	37.74

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	241985.6836	6412.16268		37.73854402	0.000	***
SALEDATE	49.15217665	2.437703702	0.171315569	20.1633105	0.000	***

Value of SALEDATE attribute, 2 to 5 miles from MidTOWN DIRECT stations

Observations	33,619
R square	0.02
Adjusted R square	0.02
Standard error of the estimate	282,412.77
F-ratio	699.54
t-ratio	61.27

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(constant)	249539.146	4072.50363		61.27413715	0.000 ***
SALEDATE	40.50237596	1.53135455	0.142775284	26.44872538	0.000 ***

Question 2

$SP2003_{year} = \alpha + \beta_1$ (ROOMS) + β_2 (OLDHOUSE) + β_3 (NEWHOUSE) + β_4 (BESTSTYL) + β_5 (SCHLSCOR) + β_6 (PGROWTH) + β_7 (TAXRATE) + β_8 (SALEDATE) + β_9 (**WALKMTD**) + ε

$SP2003_{year} = \alpha + \beta_1$ (ROOMS) + β_2 (OLDHOUSE) + β_3 (NEWHOUSE) + β_4 (BESTSTYL) + β_5 (SCHLSCOR) + β_6 (PGROWTH) + β_7 (TAXRATE) + β_8 (SALEDATE) + β_9 (**MDT_.5_2**) + ε

$SP2003_{year} = \alpha + \beta_1$ (ROOMS) + β_2 (OLDHOUSE) + β_3 (NEWHOUSE) + β_4 (BESTSTYL) + β_5 (SCHLSCOR) + β_6 (PGROWTH) + β_7 (TAXRATE) + β_8 (SALEDATE) + β_9 (**MDT_2_5**) + ε

Value of explanatory variables, including WALKMTD, 1993

Observations	1,793
R square	0.504
Adjusted R square	0.501
Standard error of the estimate	169,468.020
F-ratio	226.248
t-ratio	-11.402

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(constant)	-478,151.816	41,935.234		-11.402	0.000 ***
ROOMS	72,576.519	2,206.030	0.585	32.899	0.000 ***
OLDHOUSE	-67,674.771	11,376.898	-0.114	-5.948	0.000 ***
NEWHOUSE	52,136.197	11,255.799	0.080	4.632	0.000 ***
BESTSTYL	41,491.492	9,338.579	0.086	4.443	0.000 ***
SCHLSCOR	790.562	81.523	0.180	9.697	0.000 ***
PGROWTH	-8,875.022	816.101	-0.189	-10.875	0.000 ***
TAXRATE	-7,941.260	1,383.812	-0.106	-5.739	0.000 ***
WALKMTD	-28,044.601	15,762.605	-0.030	-1.779	0.075 *

Value of explanatory variables, including WALKMTD, 1994

Observations	1,933
R square	0.543
Adjusted R square	0.541
Standard error of the estimate	160,147.330
F-ratio	286.197
t-ratio	-13.056

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-498,455.065	38,178.668		-13.056	0.000	***
ROOMS	71,916.083	1,985.325	0.595	36.224	0.000	***
OLDHOUSE	-77,930.929	10,404.899	-0.137	-7.490	0.000	***
NEWHOUSE	73,849.881	10,205.349	0.117	7.236	0.000	***
BESTSTYL	41,289.149	8,597.889	0.087	4.802	0.000	***
SCHLSCOR	861.055	72.675	0.208	11.848	0.000	***
PGROWTH	-10,024.604	797.312	-0.206	-12.573	0.000	***
TAXRATE	-8,014.775	1,172.873	-0.123	-6.833	0.000	***
WALKMTD	17,739.033	14,195.269	0.020	1.250	0.212	

Value of explanatory variables, including WALKMTD, 1995

Observations	2,022
R square	0.554
Adjusted R square	0.552
Standard error of the estimate	155,071.530
F-ratio	312.486
t-ratio	-11.741

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-455,487.790	38,793.642		-11.741	0.000	***
ROOMS	64,625.925	1,820.319	0.576	35.503	0.000	***
OLDHOUSE	-54,629.825	9,890.346	-0.094	-5.524	0.000	***
NEWHOUSE	99,019.898	9,635.987	0.161	10.276	0.000	***
BESTSTYL	28,990.414	8,063.668	0.062	3.595	0.000	***
SCHLSCOR	885.449	74.534	0.212	11.880	0.000	***
PGROWTH	-11,017.475	729.101	-0.236	-15.111	0.000	***
TAXRATE	-8,169.188	1,052.005	-0.137	-7.765	0.000	***
WALKMTD	-13,937.930	13,502.357	-0.016	-1.032	0.302	

Value of explanatory variables, including WALKMTD, 1996

Observations	2,593
R square	0.525
Adjusted R square	0.524
Standard error of the estimate	161,275.380
F-ratio	357.363
t-ratio	-17.265

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-560,552.857	32,467.139		-17.265	0.000	***
ROOMS	70,525.802	1,740.524	0.604	40.520	0.000	***
OLDHOUSE	-65,706.803	9,354.923	-0.111	-7.024	0.000	***
NEWHOUSE	81,243.700	8,900.099	0.130	9.128	0.000	***
BESTSTYL	29,597.488	7,659.731	0.063	3.864	0.000	***
SCHLSCOR	919.756	63.567	0.220	14.469	0.000	***
PGROWTH	-7,484.309	688.534	-0.152	-10.870	0.000	***
TAXRATE	-4,143.140	779.286	-0.080	-5.317	0.000	***
WALKMTD	26,085.070	12,479.881	0.029	2.090	0.037	**

Value of explanatory variables, including WALKMTD, 1997

Observations	5,370
R square	0.521
Adjusted R square	0.520
Standard error of the estimate	149,903.750
F-ratio	728.015
t-ratio	-23.272

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-531,691.210	22,847.107		-23.272	0.000	***
ROOMS	64,991.659	1,168.053	0.569	55.641	0.000	***
OLDHOUSE	-43,802.453	5,566.176	-0.085	-7.869	0.000	***
NEWHOUSE	59,849.940	6,958.886	0.084	8.601	0.000	***
BESTSTYL	15,213.346	4,803.890	0.035	3.167	0.002	***
SCHLSCOR	936.201	45.625	0.240	20.520	0.000	***
PGROWTH	-5,614.679	439.524	-0.125	-12.774	0.000	***
TAXRATE	-6,345.906	580.897	-0.128	-10.924	0.000	***
WALKMTD	17,093.489	8,987.149	0.018	1.902	0.057	*

Value of explanatory variables, including WALKMTD, 1998

Observations	6,238
R square	0.494
Adjusted R square	0.494
Standard error of the estimate	172,105.030
F-ratio	761.599
t-ratio	-25.696

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-625,545.514	24,344.519		-25.696	0.000	***
ROOMS	66,078.425	1,205.413	0.533	54.818	0.000	***
OLDHOUSE	-51,597.126	5,913.984	-0.092	-8.725	0.000	***
NEWHOUSE	91,787.798	7,447.123	0.115	12.325	0.000	***
BESTSTYL	29,013.172	5,230.959	0.060	5.546	0.000	***
SCHLSCOR	1,151.967	48.943	0.265	23.537	0.000	***
PGROWTH	-5,305.369	464.593	-0.107	-11.419	0.000	***
TAXRATE	-6,232.723	567.719	-0.124	-10.979	0.000	***
WALKMTD	26,885.207	10,474.683	0.024	2.567	0.010	**

Value of explanatory variables, including WALKMTD, 1999

Observations	6,039
R square	0.537
Adjusted R square	0.536
Standard error of the estimate	179,522.090
F-ratio	872.852
t-ratio	-29.043

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-729,194.774	25,107.367		-29.043	0.000	***
ROOMS	74,534.059	1,259.662	0.570	59.170	0.000	***
OLDHOUSE	-48,032.811	6,258.263	-0.078	-7.675	0.000	***
NEWHOUSE	70,644.887	7,852.057	0.082	8.997	0.000	***
BESTSTYL	16,333.430	5,549.263	0.031	2.943	0.003	***
SCHLSCOR	1,307.712	50.756	0.288	25.765	0.000	***
PGROWTH	-6,066.695	498.688	-0.111	-12.165	0.000	***
TAXRATE	-4,118.136	554.056	-0.084	-7.433	0.000	***
WALKMTD	48,993.545	10,830.820	0.040	4.524	0.000	***

Value of explanatory variables, including WALKMTD, 2000

Observations	5,856
R square	0.551
Adjusted R square	0.551
Standard error of the estimate	196,587.440
F-ratio	897.924
t-ratio	-31.866

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-835,415.454	26,216.549		-31.866	0.000	***
ROOMS	81,129.091	1,371.492	0.575	59.154	0.000	***
OLDHOUSE	-47,031.603	6,965.036	-0.068	-6.753	0.000	***
NEWHOUSE	114,372.952	9,294.240	0.112	12.306	0.000	***
BESTSTYL	28,582.367	6,203.951	0.049	4.607	0.000	***
SCHLSCOR	1,484.307	54.149	0.298	27.411	0.000	***
PGROWTH	-7,260.803	560.886	-0.119	-12.945	0.000	***
TAXRATE	-2,440.304	548.198	-0.049	-4.452	0.000	***
WALKMTD	50,731.118	11,715.922	0.039	4.330	0.000	***

Value of explanatory variables, including WALKMTD, 2001

Observations	5,475
R square	0.447
Adjusted R square	0.446
Standard error of the estimate	262,345.110
F-ratio	552.227
t-ratio	-28.134

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-876,184.006	31,143.731		-28.134	0.000	***
ROOMS	86,695.645	1,826.489	0.527	47.466	0.000	***
OLDHOUSE	-59,224.488	9,672.257	-0.072	-6.123	0.000	***
NEWHOUSE	124,645.440	13,007.856	0.099	9.582	0.000	***
BESTSTYL	30,865.240	8,655.016	0.044	3.566	0.000	***
SCHLSCOR	1,581.837	66.871	0.266	23.655	0.000	***
PGROWTH	-9,197.739	755.174	-0.126	-12.180	0.000	***
TAXRATE	-2,264.026	464.271	-0.055	-4.877	0.000	***
WALKMTD	56,159.772	16,627.305	0.035	3.378	0.001	***

Value of explanatory variables, including WALKMTD, 2002

Observations	5,881
R square	0.527
Adjusted R square	0.526
Standard error of the estimate	213,514.400
F-ratio	816.493
t-ratio	-41.760

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-913,322.127	21,870.866		-41.760	0.000	***
ROOMS	81,792.734	1,435.621	0.564	56.974	0.000	***
OLDHOUSE	-19,981.254	7,566.335	-0.028	-2.641	0.008	***
NEWHOUSE	98,926.668	10,187.014	0.090	9.711	0.000	***
BESTSTYL	45,058.850	6,751.595	0.073	6.674	0.000	***
SCHLSCOR	1,695.027	48.689	0.320	34.814	0.000	***
PGROWTH	-4,099.804	582.514	-0.064	-7.038	0.000	***
TAXRATE	-146.074	65.356	-0.020	-2.235	0.025	**
WALKMTD	54,737.353	12,351.859	0.041	4.432	0.000	***

Value of explanatory variables, including WALKMTD, 2003

Observations	6,634
R square	0.540
Adjusted R square	0.540
Standard error of the estimate	234,696.240
F-ratio	972.927
t-ratio	-44.835

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-1,012,039.290	22,572.677		-44.835	0.000	***
ROOMS	92,478.333	1,482.645	0.577	62.374	0.000	***
OLDHOUSE	-35,965.432	7,849.807	-0.045	-4.582	0.000	***
NEWHOUSE	129,689.630	10,607.747	0.104	12.226	0.000	***
BESTSTYL	36,115.456	7,026.490	0.052	5.140	0.000	***
SCHLSCOR	1,832.650	51.191	0.308	35.801	0.000	***
PGROWTH	-6,965.396	594.767	-0.099	-11.711	0.000	***
TAXRATE	-102.546	63.941	-0.013	-1.604	0.109	
WALKMTD	89,965.470	13,511.010	0.056	6.659	0.000	***

Value of explanatory variables, including MTD_.5_2, 1993

Observations	1,793
R square	0.505
Adjusted R square	0.503
Standard error of the estimate	169,277.450
F-ratio	227.261
t-ratio	-11.353

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-474,423.514	41,789.345		-11.353	0.000	***
ROOMS	72,983.261	2,204.122	0.588	33.112	0.000	***
OLDHOUSE	-66,776.056	11,353.379	-0.112	-5.882	0.000	***
NEWHOUSE	52,604.088	11,244.147	0.081	4.678	0.000	***
BESTSTYL	38,085.429	9,311.627	0.079	4.090	0.000	***
SCHLSCOR	786.406	81.018	0.179	9.707	0.000	***
PGROWTH	-8,780.005	816.005	-0.187	-10.760	0.000	***
TAXRATE	-7,857.518	1,382.278	-0.105	-5.684	0.000	***
MTD_.5_2	-24,167.669	9,011.988	-0.045	-2.682	0.007	***

Value of explanatory variables, including MTD_.5_2, 1994

Observations	1,933
R square	0.543
Adjusted R square	0.541
Standard error of the estimate	160,160.610
F-ratio	286.110
t-ratio	-13.161

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-501,733.678	38,123.412		-13.161	0.000	***
ROOMS	72,034.416	1,985.702	0.596	36.277	0.000	***
OLDHOUSE	-74,979.933	10,248.019	-0.131	-7.317	0.000	***
NEWHOUSE	74,039.865	10,204.471	0.117	7.256	0.000	***
BESTSTYL	41,481.618	8,593.678	0.087	4.827	0.000	***
SCHLSCOR	871.734	72.622	0.211	12.004	0.000	***
PGROWTH	-9,962.916	798.658	-0.204	-12.475	0.000	***
TAXRATE	-7,906.085	1,175.064	-0.122	-6.728	0.000	***
MTD_.5_2	-9,180.678	8,236.904	-0.017	-1.115	0.265	

Value of explanatory variables, including MTD_.5_2, 1995

Observations	2,022
R square	0.555
Adjusted R square	0.553
Standard error of the estimate	154,856.940
F-ratio	313.400
t-ratio	-11.764

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-455,105.793	38,687.539		-11.764	0.000	***
ROOMS	64,843.182	1,821.873	0.578	35.591	0.000	***
OLDHOUSE	-55,613.009	9,738.939	-0.096	-5.710	0.000	***
NEWHOUSE	98,255.028	9,636.888	0.160	10.196	0.000	***
BESTSTYL	28,579.807	8,033.247	0.061	3.558	0.000	***
SCHLSCOR	886.457	74.254	0.212	11.938	0.000	***
PGROWTH	-10,920.935	730.234	-0.233	-14.955	0.000	***
TAXRATE	-7,999.931	1,054.552	-0.134	-7.586	0.000	***
MTD_.5_2	-16,214.108	7,790.374	-0.031	-2.081	0.038	**

Value of explanatory variables, including MTD_.5_2, 1996

Observations	2,593
R square	0.525
Adjusted R square	0.523
Standard error of the estimate	161,382.250
F-ratio	356.462
t-ratio	-17.338

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-562,873.161	32,465.365		-17.338	0.000	***
ROOMS	70,753.935	1,738.460	0.606	40.699	0.000	***
OLDHOUSE	-63,043.547	9,258.145	-0.107	-6.810	0.000	***
NEWHOUSE	82,618.965	8,938.626	0.132	9.243	0.000	***
BESTSTYL	30,686.628	7,645.209	0.065	4.014	0.000	***
SCHLSCOR	918.198	63.853	0.219	14.380	0.000	***
PGROWTH	-7,483.182	689.875	-0.152	-10.847	0.000	***
TAXRATE	-4,129.158	780.399	-0.080	-5.291	0.000	***
MTD_.5_2	6,959.275	7,170.401	0.013	0.971	0.332	

Value of explanatory variables, including MTD_.5_2, 1997

Observations	5,370
R square	0.520
Adjusted R square	0.520
Standard error of the estimate	149,938.950
F-ratio	727.359
t-ratio	-23.452

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-534,417.879	22,787.959		-23.452	0.000	***
ROOMS	65,007.839	1,168.350	0.569	55.641	0.000	***
OLDHOUSE	-42,984.492	5,543.770	-0.083	-7.754	0.000	***
NEWHOUSE	60,296.726	6,977.719	0.085	8.641	0.000	***
BESTSTYL	15,547.765	4,800.713	0.036	3.239	0.001	***
SCHLSCOR	942.662	45.454	0.242	20.739	0.000	***
PGROWTH	-5,702.910	450.139	-0.127	-12.669	0.000	***
TAXRATE	-6,432.601	585.715	-0.130	-10.982	0.000	***
MTD_.5_2	4,882.208	4,656.274	0.010	1.049	0.294	

Value of explanatory variables, including MTD_.5_2, 1998

Observations	6,238
R square	0.495
Adjusted R square	0.494
Standard error of the estimate	172,074.170
F-ratio	762.152
t-ratio	-25.453

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-621,859.882	24,431.589		-25.453	0.000	***
ROOMS	65,965.026	1,205.683	0.532	54.712	0.000	***
OLDHOUSE	-50,016.544	5,879.980	-0.089	-8.506	0.000	***
NEWHOUSE	92,665.113	7,457.706	0.116	12.425	0.000	***
BESTSTYL	28,681.009	5,234.395	0.059	5.479	0.000	***
SCHLSCOR	1,145.862	49.083	0.263	23.346	0.000	***
PGROWTH	-5,585.174	476.880	-0.113	-11.712	0.000	***
TAXRATE	-6,505.493	577.194	-0.130	-11.271	0.000	***
MTD_.5_2	15,286.467	5,145.971	0.028	2.971	0.003	***

Value of explanatory variables, including MTD_.5_2, 1999

Observations	6,039
R square	0.536
Adjusted R square	0.535
Standard error of the estimate	179,682.240
F-ratio	869.954
t-ratio	-28.991

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-729,989.585	25,179.550		-28.991	0.000	***
ROOMS	74,528.815	1,260.957	0.570	59.105	0.000	***
OLDHOUSE	-44,735.868	6,222.099	-0.073	-7.190	0.000	***
NEWHOUSE	71,009.268	7,870.699	0.082	9.022	0.000	***
BESTSTYL	15,809.918	5,568.622	0.030	2.839	0.005	***
SCHLSCOR	1,310.926	50.886	0.289	25.762	0.000	***
PGROWTH	-6,308.272	509.421	-0.116	-12.383	0.000	***
TAXRATE	-4,417.381	566.455	-0.090	-7.798	0.000	***
MTD_.5_2	16,791.256	5,396.553	0.028	3.111	0.002	***

Value of explanatory variables, including MTD_.5_2, 2000

Observations	5,856
R square	0.550
Adjusted R square	0.550
Standard error of the estimate	196,821.290
F-ratio	894.056
t-ratio	-31.951

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-839,294.552	26,267.994		-31.951	0.000	***
ROOMS	81,036.301	1,373.283	0.575	59.009	0.000	***
OLDHOUSE	-43,136.731	6,916.976	-0.063	-6.236	0.000	***
NEWHOUSE	114,341.809	9,317.202	0.112	12.272	0.000	***
BESTSTYL	28,974.420	6,222.738	0.049	4.656	0.000	***
SCHLSCOR	1,493.773	54.249	0.300	27.536	0.000	***
PGROWTH	-7,366.634	572.060	-0.121	-12.877	0.000	***
TAXRATE	-2,555.382	557.700	-0.051	-4.582	0.000	***
MTD_.5_2	13,319.257	6,067.205	0.020	2.195	0.028	**

Value of explanatory variables, including MTD_.5_2, 2001

Observations	5,475
R square	0.447
Adjusted R square	0.446
Standard error of the estimate	262,362.540
F-ratio	552.063
t-ratio	-28.263

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-879,614.117	31,122.422		-28.263	0.000	***
ROOMS	86,778.532	1,825.903	0.528	47.526	0.000	***
OLDHOUSE	-55,457.042	9,614.940	-0.068	-5.768	0.000	***
NEWHOUSE	125,802.728	13,034.960	0.100	9.651	0.000	***
BESTSTYL	30,299.278	8,666.139	0.043	3.496	0.000	***
SCHLSCOR	1,582.149	66.875	0.266	23.658	0.000	***
PGROWTH	-9,437.392	764.627	-0.130	-12.342	0.000	***
TAXRATE	-2,400.515	467.278	-0.058	-5.137	0.000	***
MTD_.5_2	27,037.755	8,273.402	0.034	3.268	0.001	***

Value of explanatory variables, including MTD_.5_2, 2002

Observations	5,881
R square	0.525
Adjusted R square	0.524
Standard error of the estimate	213,870.020
F-ratio	811.341
t-ratio	-41.911

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-919,829.043	21,947.155		-41.911	0.000	***
ROOMS	81,793.285	1,438.802	0.564	56.848	0.000	***
OLDHOUSE	-16,232.277	7,531.434	-0.023	-2.155	0.031	**
NEWHOUSE	97,101.262	10,216.750	0.088	9.504	0.000	***
BESTSTYL	46,713.362	6,763.884	0.075	6.906	0.000	***
SCHLSCOR	1,711.218	48.744	0.323	35.106	0.000	***
PGROWTH	-3,987.819	590.205	-0.062	-6.757	0.000	***
TAXRATE	-141.863	65.498	-0.020	-2.166	0.030	**
MTD_.5_2	1,610.180	6,501.686	0.002	0.248	0.804	

Value of explanatory variables, including MTD_.5_2, 2003

Observations	6,634
R square	0.537
Adjusted R square	0.537
Standard error of the estimate	235,476.710
F-ratio	961.008
t-ratio	-44.975

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-1,019,439.144	22,666.636		-44.975	0.000	***
ROOMS	92,645.086	1,489.843	0.578	62.184	0.000	***
OLDHOUSE	-29,853.361	7,831.594	-0.037	-3.812	0.000	***
NEWHOUSE	126,424.504	10,648.323	0.102	11.873	0.000	***
BESTSTYL	38,093.445	7,050.888	0.055	5.403	0.000	***
SCHLSCOR	1,852.604	51.331	0.311	36.091	0.000	***
PGROWTH	-6,824.149	603.717	-0.097	-11.304	0.000	***
TAXRATE	-110.322	64.195	-0.014	-1.719	0.086	*
MTD_.5_2	-2,979.303	6,643.441	-0.004	-0.448	0.654	

Value of explanatory variables, including MTD_2_5, 1993

Observations	1,793
R square	0.506
Adjusted R square	0.504
Standard error of the estimate	169,031.740
F-ratio	228.571
t-ratio	-11.854

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-510,498.805	43,066.539		-11.854	0.000	***
ROOMS	72,888.957	2,199.301	0.587	33.142	0.000	***
OLDHOUSE	-63,522.153	11,422.058	-0.107	-5.561	0.000	***
NEWHOUSE	52,645.166	11,227.515	0.081	4.689	0.000	***
BESTSTYL	39,318.218	9,274.502	0.082	4.239	0.000	***
SCHLSCOR	807.651	81.335	0.184	9.930	0.000	***
PGROWTH	-8,752.316	814.784	-0.186	-10.742	0.000	***
TAXRATE	-7,878.612	1,380.164	-0.106	-5.708	0.000	***
MTD_2_5	30,111.694	8,550.151	0.060	3.522	0.000	***

Value of explanatory variables, including MTD_2_5, 1994

Observations	1,933
R square	0.543
Adjusted R square	0.541
Standard error of the estimate	160,206.630
F-ratio	285.807
t-ratio	-12.843

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-504,675.243	39,294.728		-12.843	0.000	***
ROOMS	72,002.171	1,987.020	0.596	36.236	0.000	***
OLDHOUSE	-75,006.893	10,352.955	-0.131	-7.245	0.000	***
NEWHOUSE	74,114.393	10,207.491	0.118	7.261	0.000	***
BESTSTYL	41,777.747	8,591.690	0.088	4.863	0.000	***
SCHLSCOR	869.677	72.827	0.210	11.942	0.000	***
PGROWTH	-9,996.321	799.020	-0.205	-12.511	0.000	***
TAXRATE	-7,957.746	1,175.934	-0.122	-6.767	0.000	***
MTD_2_5	2,887.422	7,815.580	0.006	0.369	0.712	

Value of explanatory variables, including MTD_2_5, 1995

Observations	2,022
R square	0.555
Adjusted R square	0.553
Standard error of the estimate	154,860.040
F-ratio	314.028
t-ratio	-11.983

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-478,385.055	39,923.326		-11.983	0.000	***
ROOMS	64,883.734	1,820.644	0.578	35.638	0.000	***
OLDHOUSE	-53,037.419	9,814.500	-0.092	-5.404	0.000	***
NEWHOUSE	97,929.702	9,633.738	0.159	10.165	0.000	***
BESTSTYL	29,515.252	8,041.067	0.063	3.671	0.000	***
SCHLSCOR	897.734	74.496	0.215	12.051	0.000	***
PGROWTH	-10,888.911	730.040	-0.233	-14.915	0.000	***
TAXRATE	-7,958.339	1,053.992	-0.134	-7.551	0.000	***
MTD_2_5	19,093.987	7,448.933	0.039	2.563	0.010	**

Value of explanatory variables, including MTD_2_5, 1996

Observations	2,593
R square	0.525
Adjusted R square	0.524
Standard error of the estimate	161,278.180
F-ratio	357.340
t-ratio	-16.280

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-546,066.369	33,542.791		-16.280	0.000	***
ROOMS	70,640.885	1,738.087	0.605	40.643	0.000	***
OLDHOUSE	-64,957.243	9,308.746	-0.110	-6.978	0.000	***
NEWHOUSE	83,113.740	8,917.459	0.133	9.320	0.000	***
BESTSTYL	29,998.046	7,648.639	0.064	3.922	0.000	***
SCHLSCOR	910.010	63.893	0.217	14.243	0.000	***
PGROWTH	-7,544.430	689.974	-0.153	-10.934	0.000	***
TAXRATE	-4,196.880	780.582	-0.081	-5.377	0.000	***
MTD_2_5	-14,121.517	6,826.745	-0.029	-2.069	0.039	**

Value of explanatory variables, including MTD_2_5, 1997

Observations	5,370
R square	0.521
Adjusted R square	0.520
Standard error of the estimate	149,900.540
F-ratio	728.075
t-ratio	-22.097

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-522,804.600	23,659.621		-22.097	0.000	***
ROOMS	64,969.450	1,168.265	0.568	55.612	0.000	***
OLDHOUSE	-43,796.018	5,563.887	-0.085	-7.871	0.000	***
NEWHOUSE	60,745.250	6,975.954	0.086	8.708	0.000	***
BESTSTYL	15,090.863	4,807.320	0.035	3.139	0.002	***
SCHLSCOR	935.871	45.626	0.240	20.512	0.000	***
PGROWTH	-5,791.515	450.038	-0.129	-12.869	0.000	***
TAXRATE	-6,490.326	584.952	-0.131	-11.095	0.000	***
MTD_2_5	-8,804.396	4,488.869	-0.019	-1.961	0.050	**

Value of explanatory variables, including MTD_2_5, 1998

Observations	6,238
R square	0.495
Adjusted R square	0.495
Standard error of the estimate	171,966.780
F-ratio	764.077
t-ratio	-23.213

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-595,810.725	25,667.487		-23.213	0.000	***
ROOMS	65,940.397	1,204.841	0.532	54.730	0.000	***
OLDHOUSE	-51,224.042	5,884.011	-0.091	-8.706	0.000	***
NEWHOUSE	93,485.332	7,458.129	0.117	12.535	0.000	***
BESTSTYL	27,853.827	5,239.502	0.058	5.316	0.000	***
SCHLSCOR	1,132.611	49.280	0.260	22.983	0.000	***
PGROWTH	-5,722.930	477.563	-0.115	-11.984	0.000	***
TAXRATE	-6,637.881	577.541	-0.132	-11.493	0.000	***
MTD_2_5	-20,181.957	4,950.768	-0.039	-4.077	0.000	***

Value of explanatory variables, including MTD_2_5, 1999

Observations	6,039
R square	0.537
Adjusted R square	0.536
Standard error of the estimate	179,428.620
F-ratio	874.547
t-ratio	-26.280

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-693,975.207	26,406.618		-26.280	0.000	***
ROOMS	74,434.269	1,259.360	0.569	59.105	0.000	***
OLDHOUSE	-46,505.311	6,222.359	-0.076	-7.474	0.000	***
NEWHOUSE	72,610.354	7,867.343	0.084	9.229	0.000	***
BESTSTYL	14,515.096	5,567.174	0.028	2.607	0.009	***
SCHLSCOR	1,290.583	51.039	0.284	25.286	0.000	***
PGROWTH	-6,545.274	509.685	-0.120	-12.842	0.000	***
TAXRATE	-4,669.060	566.160	-0.095	-8.247	0.000	***
MTD_2_5	-26,867.560	5,193.041	-0.048	-5.174	0.000	***

Value of explanatory variables, including MTD_2_5, 2000

Observations	5,856
R square	0.551
Adjusted R square	0.551
Standard error of the estimate	196,596.460
F-ratio	897.775
t-ratio	-29.117

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-805,623.395	27,668.480		-29.117	0.000	***
ROOMS	81,013.060	1,371.630	0.574	59.063	0.000	***
OLDHOUSE	-44,956.071	6,921.207	-0.065	-6.495	0.000	***
NEWHOUSE	116,000.837	9,314.546	0.113	12.454	0.000	***
BESTSTYL	27,244.794	6,230.438	0.046	4.373	0.000	***
SCHLSCOR	1,473.592	54.443	0.296	27.067	0.000	***
PGROWTH	-7,654.969	573.980	-0.126	-13.337	0.000	***
TAXRATE	-2,803.338	558.707	-0.056	-5.018	0.000	***
MTD_2_5	-24,872.198	5,828.250	-0.039	-4.268	0.000	***

Value of explanatory variables, including MTD_2_5, 2001

Observations	5,475
R square	0.448
Adjusted R square	0.447
Standard error of the estimate	262,071.950
F-ratio	554.804
t-ratio	-25.957

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-838,426.402	32,300.137		-25.957	0.000	***
ROOMS	86,564.713	1,824.888	0.527	47.436	0.000	***
OLDHOUSE	-57,804.511	9,614.710	-0.070	-6.012	0.000	***
NEWHOUSE	128,899.900	13,049.523	0.103	9.878	0.000	***
BESTSTYL	28,611.465	8,669.600	0.041	3.300	0.001	***
SCHLSCOR	1,575.862	66.825	0.265	23.582	0.000	***
PGROWTH	-9,745.795	768.059	-0.134	-12.689	0.000	***
TAXRATE	-2,499.639	467.209	-0.060	-5.350	0.000	***
MTD_2_5	-38,089.131	7,971.283	-0.050	-4.778	0.000	***

Value of explanatory variables, including MTD_2_5, 2002

Observations	5,881
R square	0.526
Adjusted R square	0.525
Standard error of the estimate	213,761.000
F-ratio	812.917
t-ratio	-40.419

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-906,857.435	22,436.587		-40.419	0.000	***
ROOMS	81,689.449	1,438.045	0.563	56.806	0.000	***
OLDHOUSE	-17,492.035	7,545.030	-0.024	-2.318	0.020	**
NEWHOUSE	99,090.141	10,226.498	0.090	9.690	0.000	***
BESTSTYL	45,351.077	6,773.949	0.073	6.695	0.000	***
SCHLSCOR	1,713.435	48.635	0.323	35.230	0.000	***
PGROWTH	-4,223.083	591.790	-0.066	-7.136	0.000	***
TAXRATE	-148.100	65.482	-0.020	-2.262	0.024	**
MTD_2_5	-15,281.420	6,211.452	-0.023	-2.460	0.014	**

Value of explanatory variables, including MTD_2_5, 2003

Observations	6,634
R square	0.538
Adjusted R square	0.537
Standard error of the estimate	235,250.730
F-ratio	962.923
t-ratio	-43.217

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	-1,005,282.240	23,261.247		-43.217	0.000	***
ROOMS	92,363.062	1,489.399	0.576	62.014	0.000	***
OLDHOUSE	-32,013.541	7,855.662	-0.040	-4.075	0.000	***
NEWHOUSE	128,723.442	10,654.605	0.104	12.081	0.000	***
BESTSTYL	36,817.433	7,053.265	0.053	5.220	0.000	***
SCHLSCOR	1,856.651	51.245	0.312	36.231	0.000	***
PGROWTH	-7,125.826	603.963	-0.101	-11.798	0.000	***
TAXRATE	-116.795	64.134	-0.015	-1.821	0.069	*
MTD_2_5	-17,267.627	6,392.822	-0.023	-2.701	0.007	***

Question 3

Value of SALEDATE attribute, all station areas, all years

Observations	5,440
R square	0.042
Adjusted R square	0.042
Standard error of the estimate	270,179.200
F-ratio	239.493
t-ratio	-14.734

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	257,439.939	7,889.670		32.630	0.000	***
SALEDATE	50.241	3.246	0.205	15.476	0.000	***

Value of SALEDATE attribute, Madison station area, all years

Observations	317
R square	0.151
Adjusted R square	0.148
Standard error of the estimate	279,575.090
F-ratio	55.963
t-ratio	-7.248

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	276,854.748	32,558.542		8.503	0.000	***
SALEDATE	103.867	13.884	0.388	7.481	0.000	***

Value of SALEDATE attribute, Chatham station area, all years

Observations	705
R square	0.204
Adjusted R square	0.203
Standard error of the estimate	118,351.030
F-ratio	180.387
t-ratio	-12.782

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	282,206.025	9,196.308		30.687	0.000	***
SALEDATE	53.200	3.961	0.452	13.431	0.000	***

Value of SALEDATE attribute, Summit station area, all years

Observations	342
R square	0.026
Adjusted R square	0.023
Standard error of the estimate	405,824.650
F-ratio	8.944
t-ratio	-2.817

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	450,592.341	62,198.038		7.244	0.000	***
SALEDATE	70.734	23.651	0.160	2.991	0.003	***

Value of SALEDATE attribute, Short Hills station area, all years

Observations	606
R square	0.116
Adjusted R square	0.114
Standard error of the estimate	393,044.140
F-ratio	79.206
t-ratio	-8.595

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	398,121.481	31,658.497		12.576	0.000	***
SALEDATE	123.551	13.882	0.340	8.900	0.000	***

Value of SALEDATE attribute, Millburn station area, all years

Observations	293
R square	0.195
Adjusted R square	0.192
Standard error of the estimate	138,448.500
F-ratio	70.471
t-ratio	-8.010

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	290,976.843	16,392.130		17.751	0.000	***
SALEDATE	59.005	7.029	0.442	8.395	0.000	***

Value of SALEDATE attribute, Maplewood station area, all years

Observations	424
R square	0.292
Adjusted R square	0.290
Standard error of the estimate	112,188.330
F-ratio	174.054
t-ratio	-12.731

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	215,363.211	11,330.450		19.007	0.000	***
SALEDATE	65.264	4.947	0.540	13.193	0.000	***

Value of SALEDATE attribute, South Orange station area, all years

Observations	342
R square	0.130
Adjusted R square	0.128
Standard error of the estimate	130,206.860
F-ratio	8.944
t-ratio	-9.778

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	176,675.485	10,698.775		16.514	0.000	***
SALEDATE	43.986	4.315	0.360	10.195	0.000	***

Value of SALEDATE attribute, Mountain station area, all years

Observations	534
R square	0.080
Adjusted R square	0.078
Standard error of the estimate	163,020.890
F-ratio	46.212
t-ratio	-6.507

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	186,300.072	15,364.940		12.125	0.000	***
SALEDATE	42.867	6.306	0.282	6.798	0.000	***

Value of SALEDATE attribute, Highland station area, all years

Observations	521
R square	0.032
Adjusted R square	0.030
Standard error of the estimate	109,432.700
F-ratio	17.166
t-ratio	-3.852

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	147,176.044	10,041.747		14.656	0.000	***
SALEDATE	17.226	4.158	0.179	4.143	0.000	***

Value of SALEDATE attribute, Orange station area, all years

Observations	625
R square	0.049
Adjusted R square	0.048
Standard error of the estimate	205,144.320
F-ratio	32.431
t-ratio	-5.441

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	188,924.743	18,775.394		10.062	0.000	***
SALEDATE	42.142	7.400	0.222	5.695	0.000	***

Value of SALEDATE attribute, Brick Church station area, all years

Observations	273
R square	0.012
Adjusted R square	0.008
Standard error of the estimate	224,292.000
F-ratio	3.201
t-ratio	-1.657

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	191,261.228	31,842.423		6.006	0.000	***
SALEDATE	21.557	12.049	0.108	1.789	0.075	*

Value of SALEDATE attribute, East Orange station area, all years

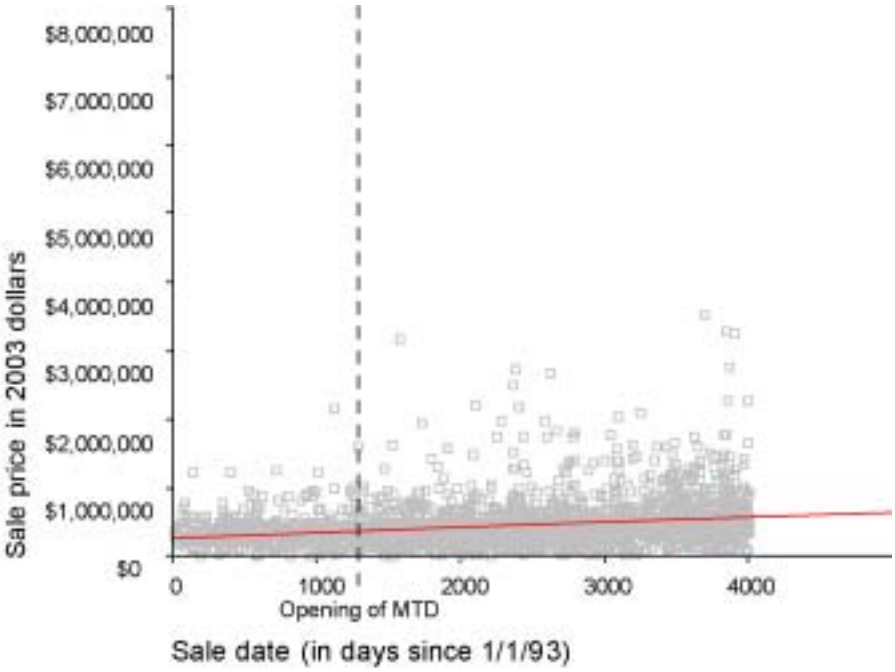
Observations	99
R square	0.024
Adjusted R square	0.013
Standard error of the estimate	38,851.390
F-ratio	2.394
t-ratio	-1.409

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	t	Sig.	
(constant)	62,781.059	10,484.230		5.988	0.000	***
SALEDATE	5.701	3.685	0.155	1.547	0.125	

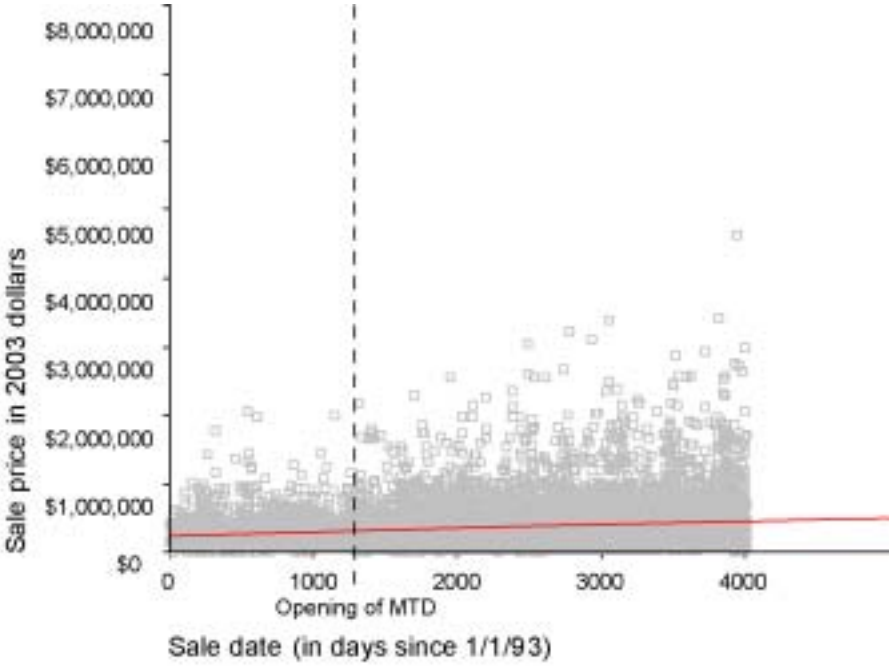
APPENDIX F: RESULTS – SCATTER PLOTS AND BEST-FIT LINES

Question 1

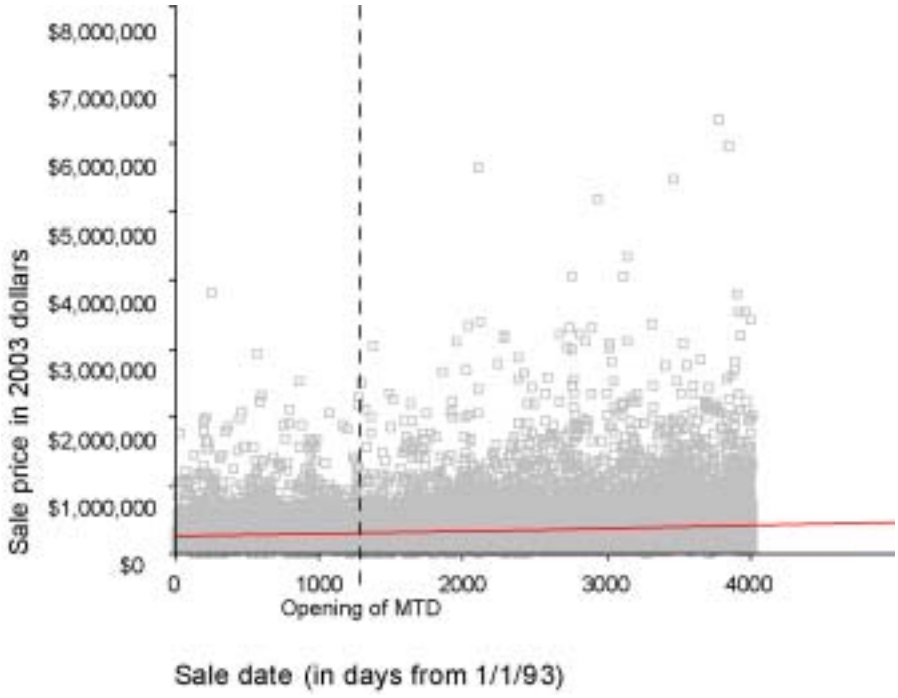
Scatter plot and best-fit line for properties located 0 to 0.5 miles from MidTOWN DIRECT stations



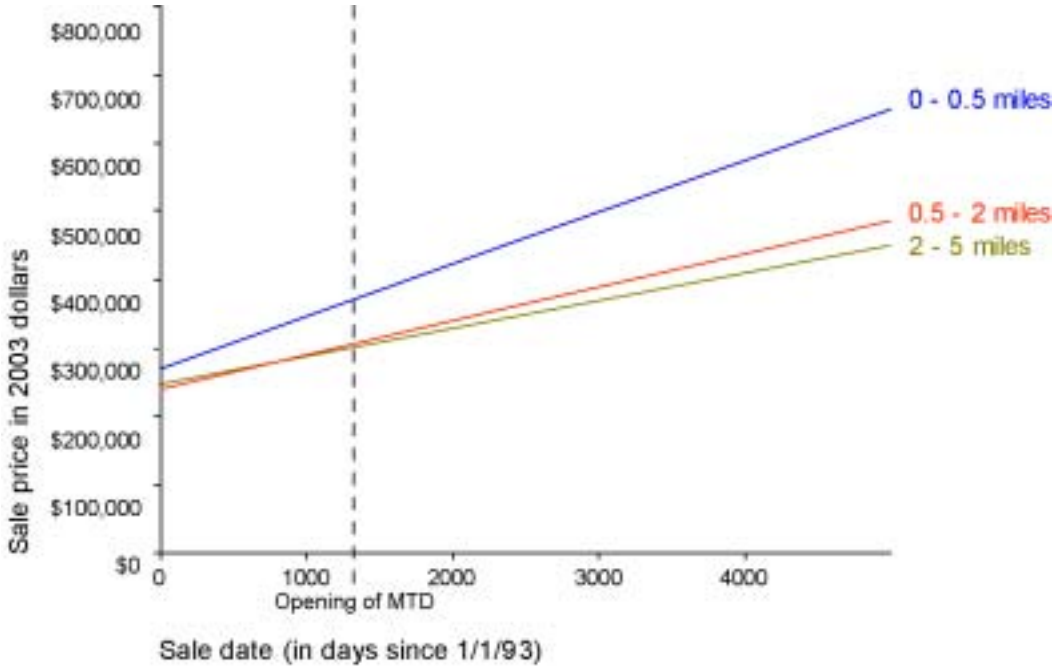
Scatter plot and best-fit line for properties located 0.5 to 2 miles from MidTOWN DIRECT stations



Scatter plot and best-fit line for properties located 2 to 5 miles from MidTOWN DIRECT stations

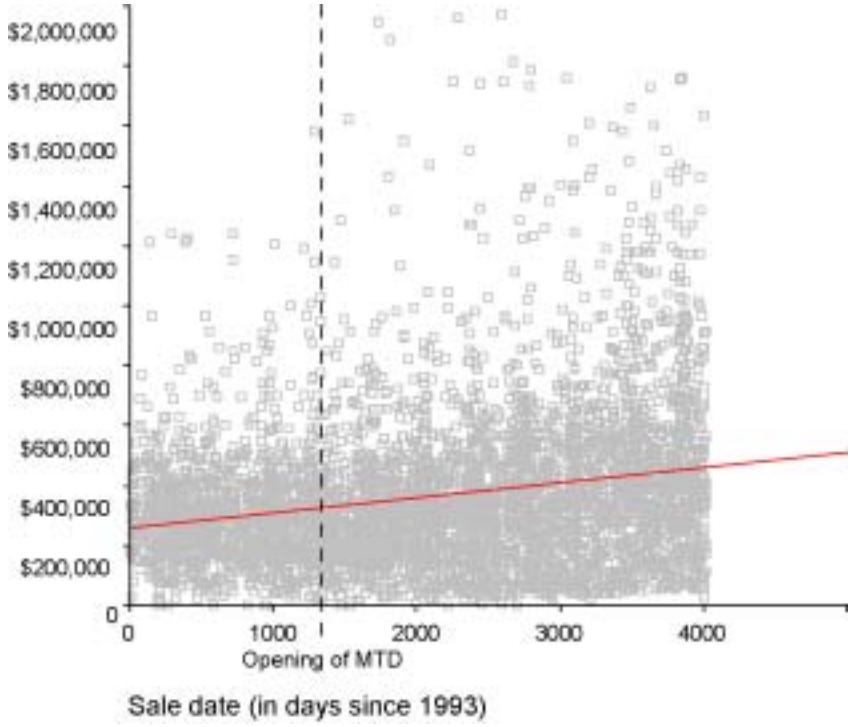


Best-fit lines, by distance category

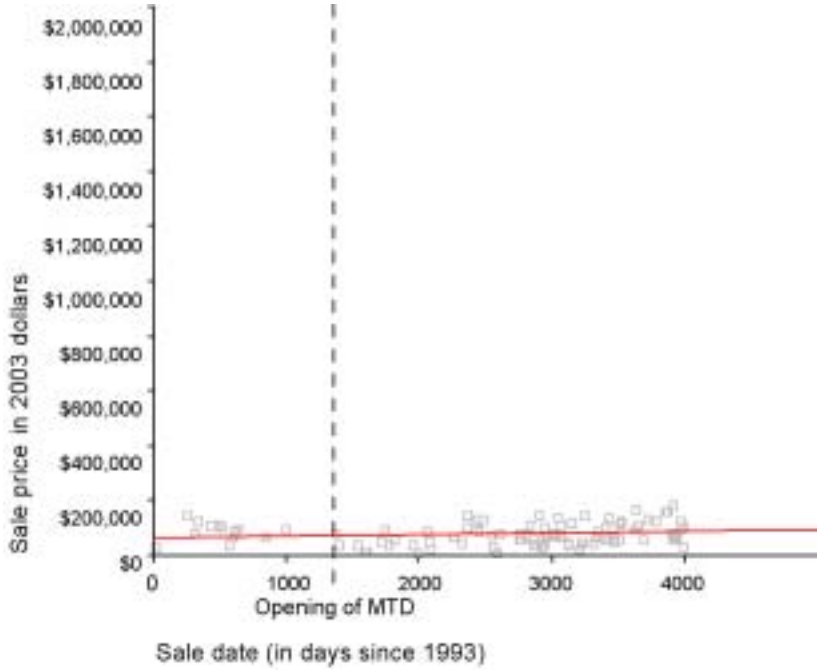


Question 3

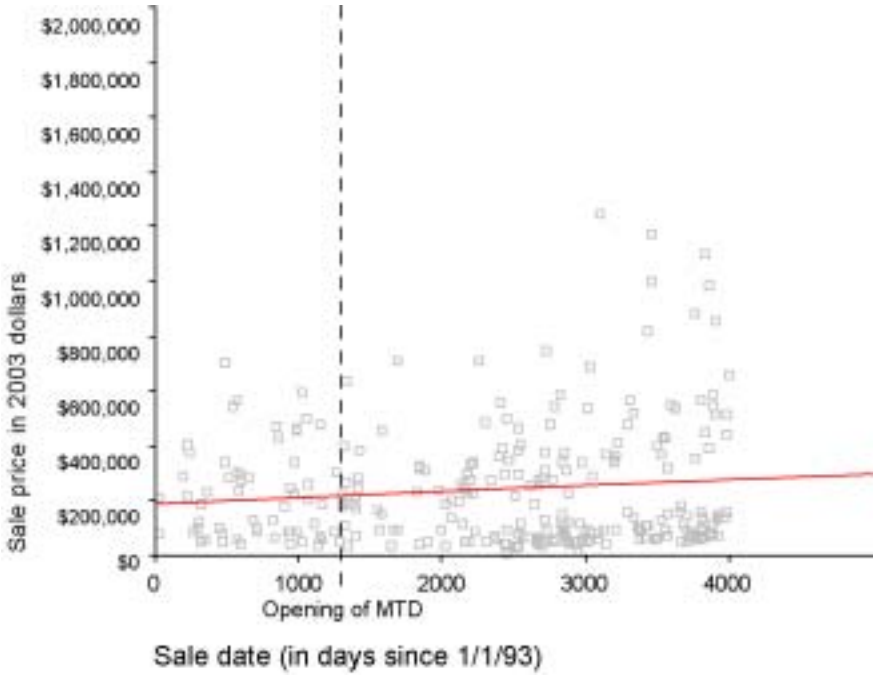
Scatter plot and best-fit line, all properties located within one-half mile of all twelve stations



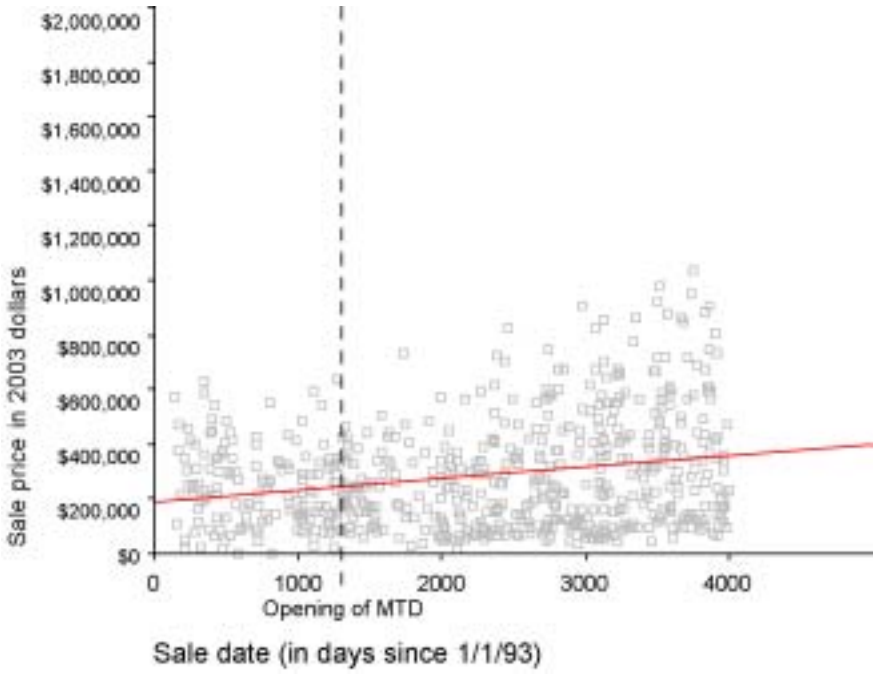
Scatter plot and best-fit line, all properties located within one-half mile of East Orange Station



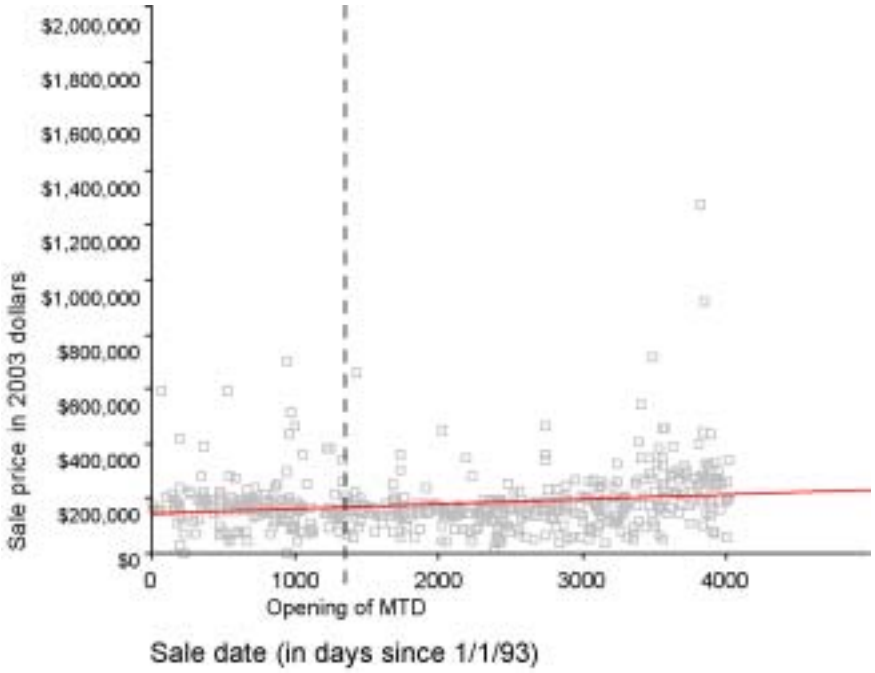
Scatter plot and best-fit line, all properties located within one-half mile of Brick Church Station



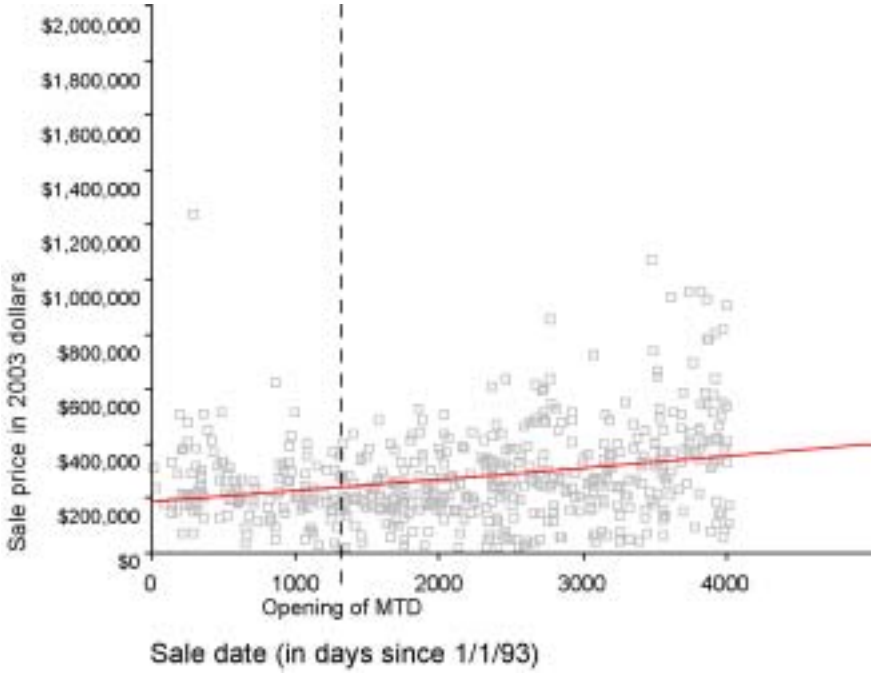
Scatter plot and best-fit line, all properties located within one-half mile of Orange Station



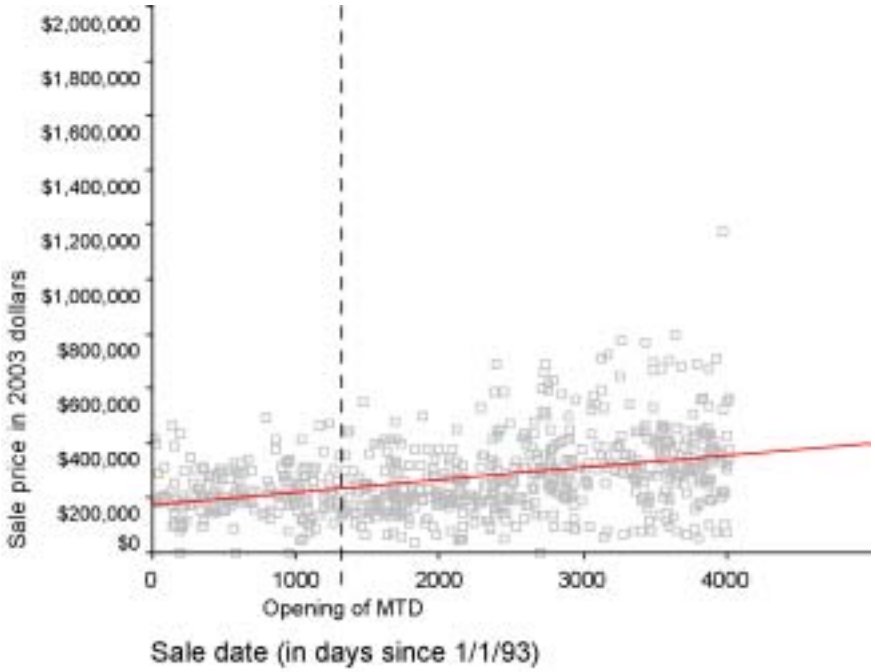
Scatter plot and best-fit line, all properties located within one-half mile of Highland Station



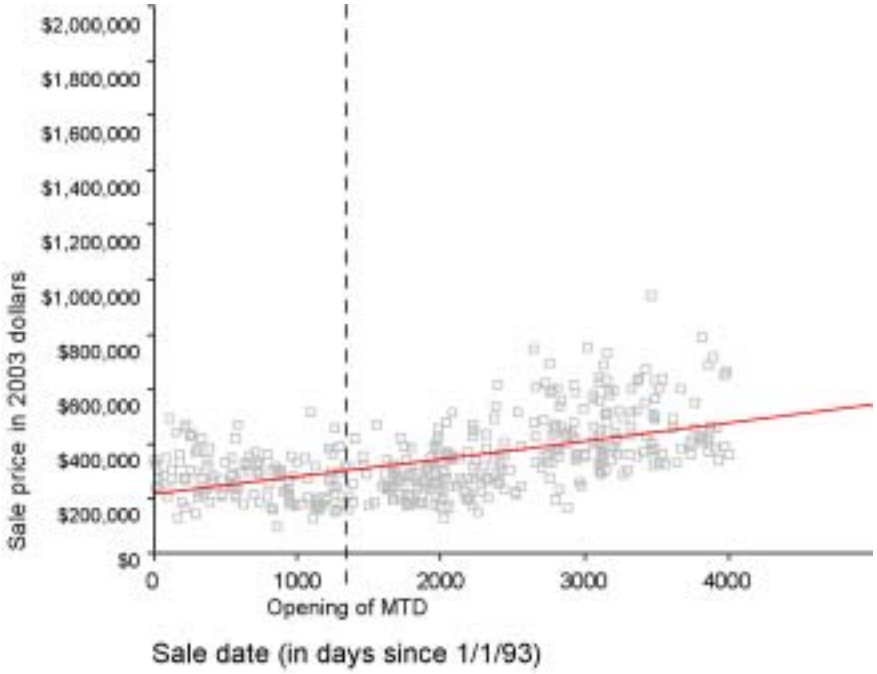
Scatter plot and best-fit line, all properties located within one-half mile of Mountain Station



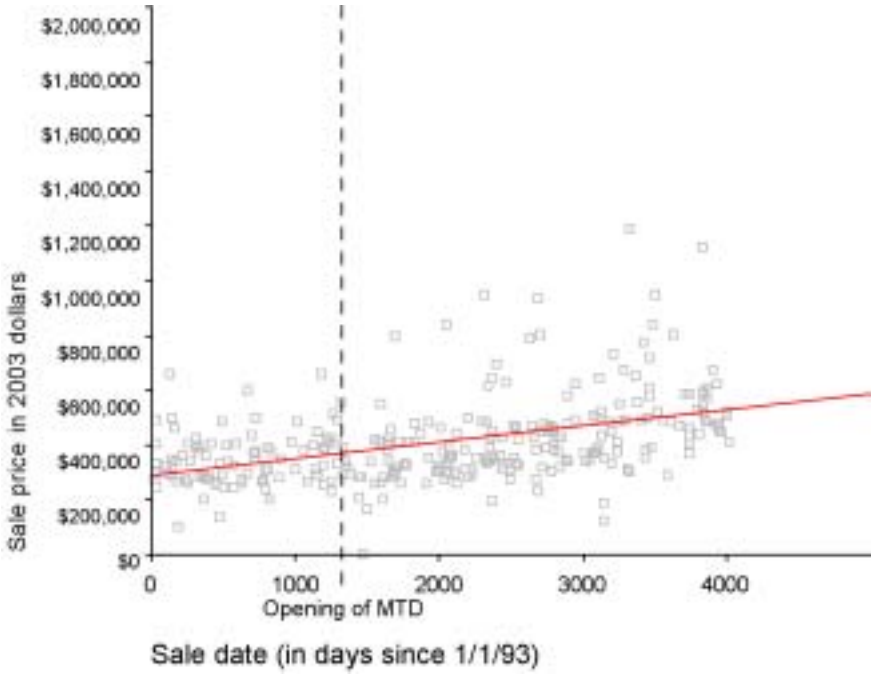
Scatter plot and best-fit line, all properties located within one-half mile of South Orange Station



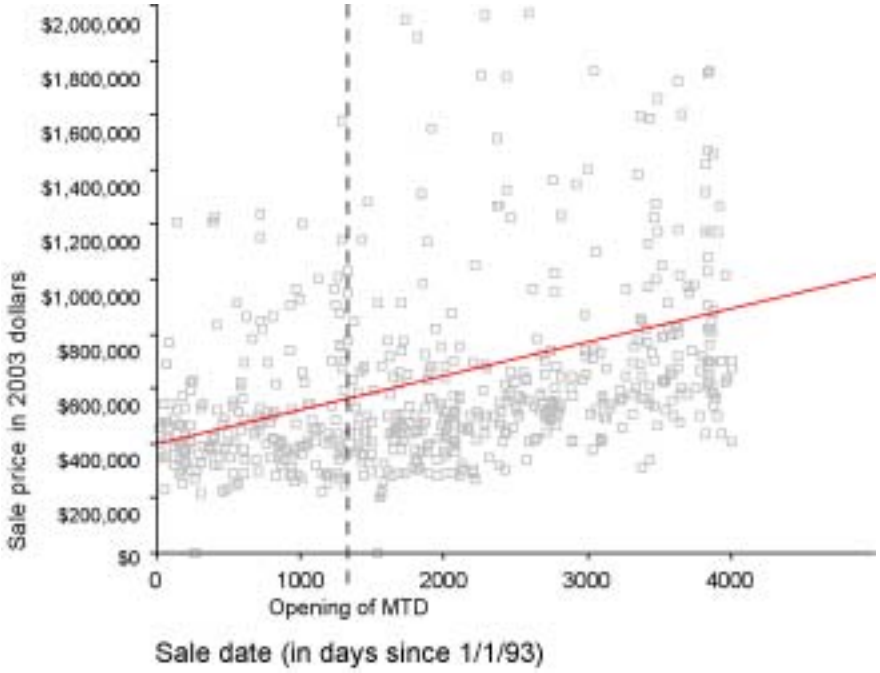
Scatter plot and best-fit line, all properties located within one-half mile of Maplewood Station



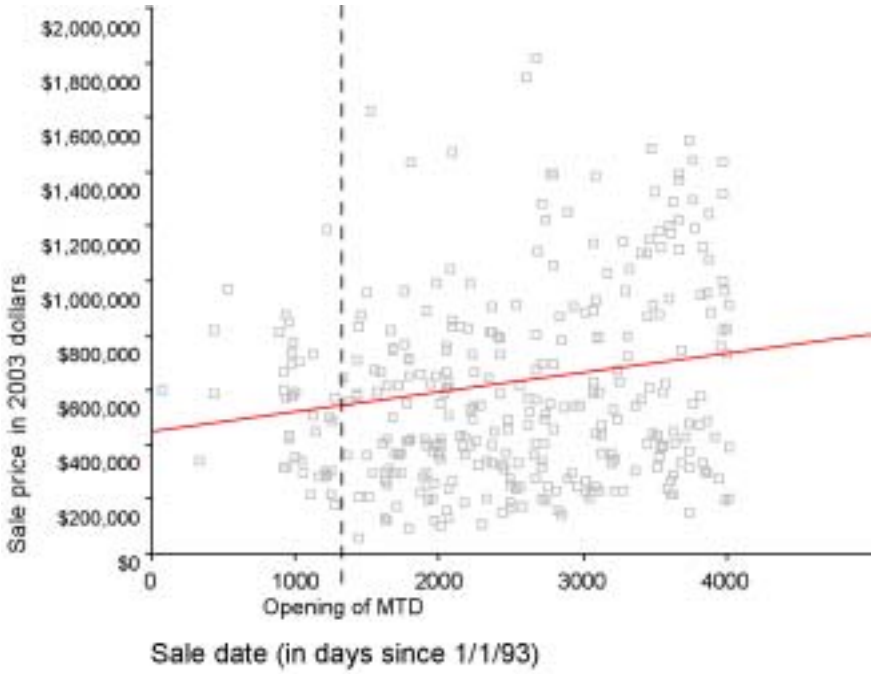
Scatter plot and best-fit line, all properties located within one-half mile of Millburn Station



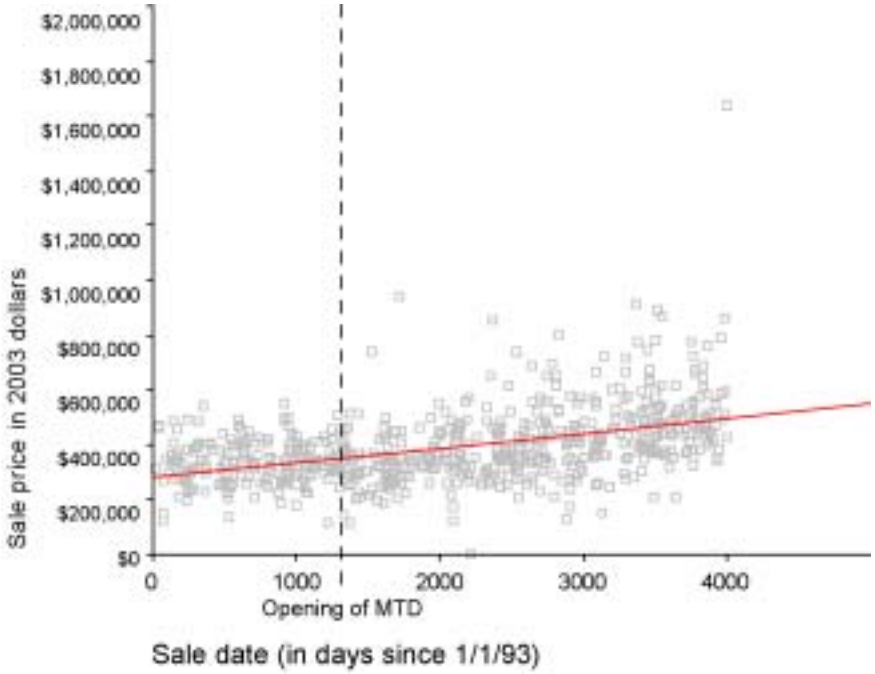
Scatter plot and best-fit line, all properties located within one-half mile of Short Hills Station



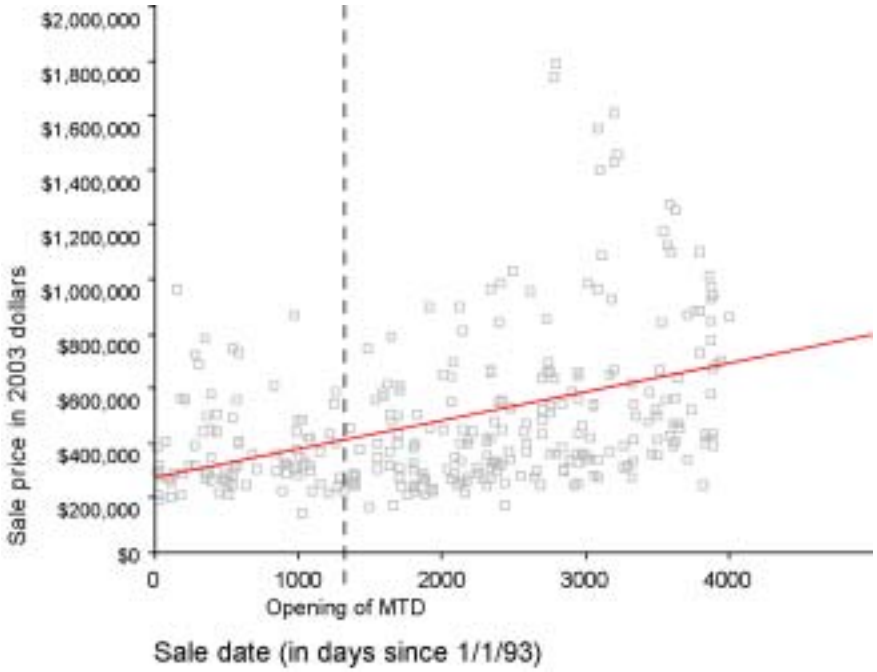
Scatter plot and best-fit line, all properties located within one-half mile of Summit Station



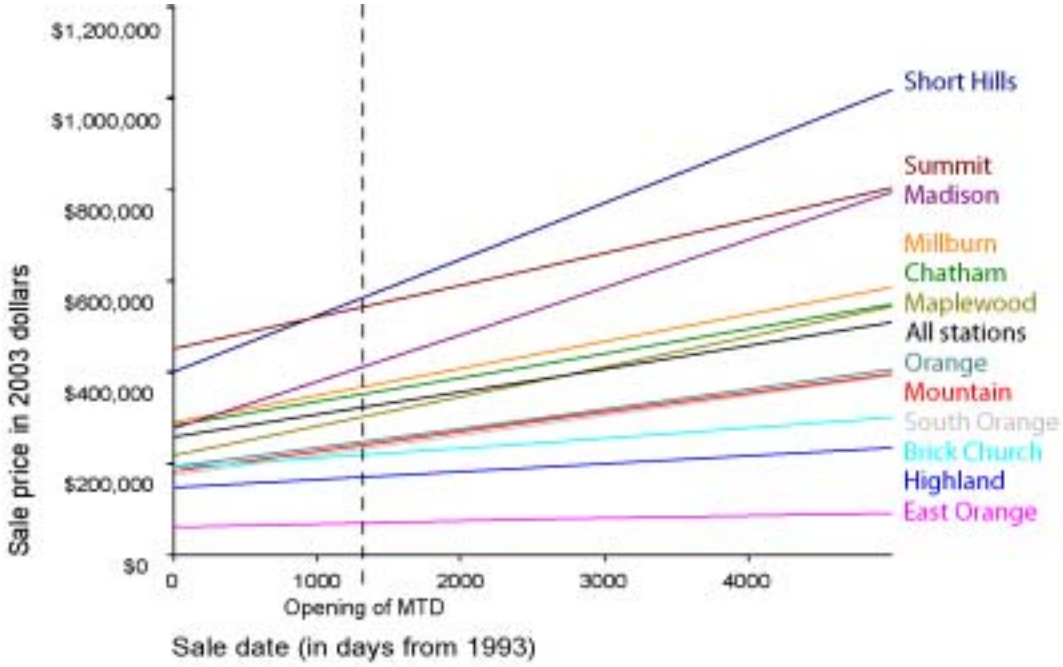
Scatter plot and best-fit line, all properties located within one-half mile of Chatham Station



Scatter plot and best-fit line, all properties located within one-half mile of Madison Station



Sale price best-fit lines in 2003 dollars, by station area



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