Residential Property Values and the New Jersey Transit Village Program

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Word count: 7000
Tables/figures: 15

Submitted for *PRESENTATION ONLY* to the 90th Annual Meeting of the Transportation Research Board

Abstract

Since 1999 New Jersey has designated 22 Transit Villages in municipalities around the state with the intention of intensifying development around rail stations and bus hubs. As one test of the effectiveness of this state-effort, we investigate the extent to which residential properties appreciated in value and price more quickly within municipalities that have been designated Transit Villages over the last decade. We find limited evidence and attribute the lack of robust findings at least in part to the less-than-perfect manner in which Transit Villages could be instrumented in our regressions. As a result, we suggest that the forethought, commitment and political will required to apply for Transit Village status may be what sparks municipal development rather than the designation itself.

Introduction

Since its inception in 1999, New Jersey's Transit Village initiative was designed to encourage "smart growth" near transit stations. That is, it was intended that they would foster transportation-efficient community redevelopment and revitalization centered upon transit facilities (rail stations and bus hubs). Naturally, it was believed that such an increased transit focus would reduce traffic congestion and improve air quality within the state.

To be considered for designation by the state, a municipality had to adopt land use entitlements necessary to advance transit-oriented development (TOD) and had to demonstrate its commitment to redeveloping the half-mile area around the transit facility into compact, mixed-use neighborhoods with a strong residential component. Specifically, according to the 2009 Statement of Qualification for Transit Village Designation, several measures used to evaluate potential Transit Villages included the presence and potential for: affordable housing, bicycle and pedestrian improvements, placemaking efforts (e.g., public amenities, such as parks, plazas, and historic resources), existence of a local management organization (e.g., Special Improvement Districts, Chamber of Commerce, Urban Enterprise Zone or Main Street organization), and community events.

Wells and Renne (2003) note that apparent success factors for obtaining designation included strong local leadership, a history of municipal planning and a sustained vision of redevelopment, entrepreneurial attitude, a willingness to foster pedestrian and bicycle access to the downtown and station areas, support for the commercial area through downtown partnerships, Main Street programs, or enterprise zones, and a sensitivity to "quality-of-life" issues by including parks, recreation areas, and cultural assets in redevelopment goals.

Designated municipalities qualify for priority funding and technical assistance from some state agencies, as well as for grants from the state's Department of Transportation. In addition, once designated, a municipality was entitled to a $100,000 grant to be used for either planning or physical infrastructure improvements. As of mid-year 2010, New Jersey had designated 22 municipalities as Transit Villages.[1]

A natural inclination is to test whether Transit Village designation has, in fact, encouraged community revitalization and redevelopment as was hoped. Indeed, increases in the intensity of development might lead to increased transit ridership due to proximity to transit. Research since the theory elucidated by (Alonso 1964) has shown that as land use becomes more intense, property values should rise. For this reason we investigate the extent to which property values appreciated in the wake of Transit Village designation.

The Context of New Jersey’s Transit Villages

The rail network in New Jersey is relatively extensive, providing ample opportunity for TOD planning throughout the state. The network focuses upon commuter rail service provided by NJ TRANSIT, which is fed by bus lines and automobiles. NJ TRANSIT includes eight rail lines, that focus on delivering commuters to Penn Station in New York City and to Hoboken, which lies directly across the Hudson River from Manhattan. The latter has both ferry and PATH subway connections to Manhattan. PATH is a rail line that serves Hoboken, Jersey City, Newark and Manhattan. The Hudson-Bergen Light Rail (HBLR) serves a very densely populated set of communities in Hudson County (connecting Bayonne, Jersey City, Hoboken, Weehawken, Union City and North Bergen), the core of which has experienced major development even prior to the inception of HBLR. Newark, lying along NJ TRANSIT’s Northeast Corridor Line, is another focal point of the rail system. In addition to PATH and NJ TRANSIT, the city is

[1] Somerville and Montclair were designated in 2010, Orange was designated in 2009, beyond the scope of our time-series.

also served by the Newark Light Rail system, historically a relatively small subway system for the city that has been expanded to connect the city's two rail stations, Newark Penn Station and Broad Street Station. In South Jersey, NJ TRANSIT provides rail service between Philadelphia and Atlantic City, SEPTA provides service from two stations in and near Trenton to Philadelphia, and PATCO provides service from Philadelphia to the South Jersey suburbs. The RiverLINE, completed in 2004, runs between Trenton and Camden, and was developed partly to spur economic development in older industrial communities along the Delaware River.

New Jersey's 20 Transit Villages are listed in **Error! Reference source not found.** along with the year in which they were designated, the municipality and county in which they are located, the rail line that runs through them, 2008 average rail boardings and 2008 population estimates. **Error! Reference source not found.** displays these on a map in the context of New Jersey's rather extensive rail network. Note that all of the Transit Villages except Pleasantville, located near Atlantic City, are at rail stations; Pleasantville is focused on a bus terminal. As can be seen, there is a wide degree of variation in patronage of the various Transit Village stations as well as in their distribution throughout the state.

In the course of investigations, it became clear that the factors that enabled Transit Village designation are both difficult to engender and fragile. For example, Burlington City's former Mayor Darlene Scocca had championed the application to the Transit Village Initiative. But with a change in administration and personnel, political and financial support for the effort was quickly redirected to other ventures. In the case of Bound Brook, lack of consistent leadership as well as the lack of an on-staff planner has resulted in little improvement in the Transit Village. These issues are important in the interpretation of our results, and we return to them later.

Table 1: Transit Village Stations

Station	Rail line	Rail boardings FY08	Year designated Transit Village	County	Municipality	Population
Belmar	North Jersey Coast Line	402	2003	Monmouth	Belmar	5,908
Bloomfield	Montclair-Boonton Line	998	2003	Essex	Bloomfield	43,885
Bound Brook	Raritan Valley Line	726	2003	Somerset	Bound Brook	10,365
Burlington City	RiverLINE	543	2007	Burlington	Burlington City	9,396
Collingswood	PATCO	1,743	2003	Camden	Collingswood	13,817
Cranford	Raritan Valley Line	1,172	2003	Union	Cranford	21,895
Elizabeth	Northeast Corridor	4,273	2007	Union	Elizabeth	124,755
Journal Square	PATH	26,869	2005	Hudson	Jersey City	241,114
Matawan	North Jersey Coast Line	3,306	2003	Monmouth	Matawan	8,754
Metuchen	Northeast Corridor	4,001	2003	Middlesex	Metuchen	13,098
Morristown	Morristown Line	2,218	1999	Morris	Morristown	19,268
Netcong	Morristown Line	237	2005	Morris	Netcong	3,222
New Brunswick	Northeast Corridor	6,129	2005	Middlesex	New Brunswick	51,149
Orange	Morristown Line	1,160	2009	Essex	Orange	31,058
Pleasantville	Bus Terminal	NA	1999	Atlantic	Pleasantville	18,853
Rahway	Northeast Corridor	3,244	2002	Union	Rahway	28,624
Riverside	RiverLINE	402	2001	Burlington	Riverside	7,693
Rutherford	Bergen County Line	1,026	1999	Bergen	Rutherford	17,454
South Amboy	North Jersey Coast Line	1,313	1999	Middlesex	South Amboy	7,777
South Orange	Morristown Line	3,450	1999	Essex	South Orange	15,882

Figure 1: Locations of Transit Villages

Theoretical Framework and Methods

It is well known that access to transportation facilities, and in particular rail stations, provides a premium to residential property values. (Alonso 1964) demonstrated it formally, showing that improved accessibility, as expressed by lower commuting costs[2] to a central business district (CBD), should motivate increases in property values for any given location within commuting distance of that CBD.

Studies that have evaluated property value changes around transit stations have yielded mixed results (Vessali 1996, Debrezion, Pels & Rietveld 2007). The consensus view is that land prices are enhanced, but there are differences between commercial and residential values. In particular, the values of residential properties very close to rail stations sometimes appear to suffer (Bowes, Ihlanfeldt 2001). The mixed results that are found in many studies are possibly attributable to how the planning for development around a station is implemented. A transit station with large amounts of parking or zoning restrictions on development may not have the same level of property price appreciation (Vessali 1996, Bowes, Ihlanfeldt 2001).

Another important feature of Transit Villages (or transit-oriented development) is that various non-accessibility amenity features, such as sidewalk enhancements, public plazas, and architectural features, are often part of the overall plan. These can also enhance property values (Bartholomew, Ewing 2010). Hedonic analysis has been applied to isolate some of these features (Song, Knaap 2003, Plaut, Boarnet 2003). While our analysis does not explicitly control for localized amenities, many of the municipalities designated as Transit Villages have a mix of features that enhance walkability, at least near the transit station. Our analysis captures both accessibility and amenity features, as well as a likely

[2] Implied in his work is that such costs include both the commuter's time and the actual cost of transportation.

indicator of an active community planning process, as expressed through the designation of a municipality as a Transit Village.

Two recent studies have also examined property appreciation along two new light rail systems in New Jersey, the RiverLINE and the Hudson-Bergen Light Rail (HBLR) (Kim, Lahr 2010, Chatman, Tulach & Kim under review). Both of these studies used repeated sales data; for the RiverLINE study this enabled changes before and after opening of the line (in 2004) to be captured. The HBLR study enabled station openings to also be evaluated, although its station openings were staged across time. Of note for this study, is that the RiverLINE seems to have had, at best, a neutral effect on housing price appreciation, but with some sub-samples, such as lower income areas seeing an increase. The HBLR study found price appreciation as far as a half mile from its most remote stations: this was off-set by a slight nuisance effect for those properties immediately next to the line. The context and economic opportunities of each line are quite different with the RiverLINE running through impoverished industrial towns along the Delaware River while the HBLR runs along New Jersey's densely populated and rapidly developing 'Gold Coast' directly across the Hudson River from Manhattan. Two of the Transit Villages are in municipalities along the RiverLINE, while none is designated at an HBLR station (one surrounds a PATH station in Jersey City, not too distant from the HBLR).

Our approach is analytical but also supplemented with selected case studies. We gathered data on residential property values and other factors generally known to influence property values in order to conduct a hedonic regression analysis; these ranged from school test scores to crime rates. Our key variable of interest was a control for whether or not a municipality was designated a Transit Village. We estimate models based on municipal level averages in an attempt to control for other policies that affect municipal-level property values. Most hedonic models use individual property data, however, given that we are looking at overall effects associated with the Transit Village, instead of the details of how distant a property is, we feel this is the correct approach. Our fixed effect analysis also controls for unknown heterogeneity associated with municipalities; a recent study examining residential property values in London also used a similar analysis that averaged property values at the postcode level (Gibbons, Machin 2005). We estimate both cross-sectional time-series models as well as a cross-sectional model of the change in property values.

One of the key issues is that the price of housing is not determined solely by access to good transit. For this reason, our modeling work included other control variables, such as the crime rate, school quality, and population density. We attempted several approaches, including a time-series cross-sectional model, as well as a cross-sectional model of changes in prices.

Research to evaluate how housing prices are affected by various factors typically uses the actual sale price for individual units. We opted to use average municipal values (using two different measures of value) for several reasons. First, the data at the municipality level allows us to use panel data methods that account for heterogeneity across municipalities, similar to the work of (Gibbons, Machin 2005) in London. This allows us to control for unmeasured attributes that may affect housing values. Second, much of the readily available data is recorded at the level of municipalities, making this a convenient unit for analysis. Finally, as we are seeking to determine how the Transit Village may affect the municipality as a whole, our approach uses the relevant unit of analysis. Further, when individual housing units are analyzed, one requires detailed information on housing characteristics that may not be available and in many cases are time-invariant and more suitable for a cross-sectional analysis. Housing values are often lower when very close or adjacent to a rail station due to various negative externalities such as increased traffic and noise, and possibly perceptions of crime; however, values increase within a short walking distance (Bowes, Ihlanfeldt 2001). Thus, the municipal level should average out these very localized effects and give us a better indication of whether the Transit Village designation has any impact on overall municipal housing values. In an analysis of Philadelphia suburban house values, a study by (Voith 1993) found little difference between aggregate census tract estimations with micro-data estimations, which lends further support to our approach.

Cross-sectional time-series model

Our cross-sectional time-series modeling framework includes various control variables. Specifically we include information on population density, crime, the effective property tax rate, school test scores, and the number of riders using the rail station. One difficulty with this sort of modeling is that our independent variables are not strictly exogenous. Some may be the result of higher housing prices. For example, better test scores may reflect socio-economic factors that are a result of higher housing prices. The designation of a Transit Village may also be endogenous in that those areas that were designated may have been seen as ripe for development due to increased demand and higher property values, or conversely, the designation may be an attempt to spur development of an economically deprived area.

Another modeling issue is that property values are largely dependent on the property value in prior years. Thus, we need to include the prior year's property value as a lagged dependent variable in our model. This introduces a problem of serial correlation which leads to a violation of the statistical assumptions in a basic ordinary least squares regression model in that the error term is no longer independently distributed. For practical purposes this means that the test statistics are unreliable. We use the Prais-Winsten method to correct for this. Using a lagged dependent variable also provides the opportunity to develop a causal model using a Generalized Methods of Moment estimator, that uses instruments of both lags and differences of the dependent variables (Arellano, Bover 1995, Blundell, Bond 1998). However, these methods are very sensitive and as we discuss below our instruments are very weak, making the estimates unreliable and potentially erroneous (Roodman 2009).

Our theoretical model is the following:

$$\ln(P_{it}) = \beta_1 \ln(P_{i,t-1}) + \beta_2 D_{it} + \beta_3 S_{it} + \beta_4 C_{it} + \beta_5 T_{it} + \beta_6 R_{it} + \beta_7 V_{it} + \sum_{1}^{t-1} \beta_t Y_t + \alpha_i + \eta_{it},$$

where *P* is the average sales price for the spatial unit of analysis, in this case a municipality, which is also lagged by one year on the right-hand side. *D* represents the population density (which proxies for demand for housing), *S* is school quality (based on test scores), *C* is crime (total murders or violent crime rates), *T* represents the tax rate, *R* represents the number of rail riders accessing stations in the municipality, and V represent the designation of whether it is a Transit Village (which varies over time). We also include a year dummy variable, Y, which controls for similar factors that vary over time in each municipality. The β are parameters which are estimated, the α is a fixed effect parameter, and η is the error term. The estimate is across all spatial units, *i*, and time series, *t*. We use a log-linear specification which is common in the hedonic pricing literature.

Other variables would in theory be desirable to include. These include the relative walkability of the station area, a measure of distance to the station, and distance from New York or Philadelphia. However, some of these variables do not change over time (or we do not have time-varying data available); in a fixed effects model they are correlated with the fixed effects term and, will thus, drop out of the model. In theory these types of time-invariant measures are controlled for by the fixed effects term (a categorical variable for each municipality less one) but we cannot draw any conclusions about how they may affect the dependent variable. This shortcoming is actually one of the benefits of using a panel fixed effects method, as it enables us to control for unmeasured attributes that likely affect the dependent variable. Our cross-sectional analysis, discussed below, does allow us to examine some of these time-invariant measures.

We have various expectations about the effects we expect from our modeling. First, our working hypothesis is that we will find that Transit Village designation increases housing values. It is possible however, that Transit Villages will experience an increase in the supply of housing that leads to an indeterminate effect on the value of housing. We control for the number of housing units and expect this to exhibit a negative sign; although higher housing values may also be contemporaneous with increased supply. Crime is assumed to have a negative association with housing values, as are poor student test scores. Other control variables include the population density, which could work both ways; first, higher densities typically are associated with higher land values, however this may not affect housing values if supply is adequate, so the effect may be indeterminate. The effective property tax rate is also used as a control and our expectation is that this would have a negative association.

Cross-sectional analysis

As an alternative to the cross-sectional time-series analyses, more traditional cross-sectional analyses were performed as well. Rather than specifying the current price of properties, however, we use the change in residential property sales prices (by municipality) as the dependent variable. This allows us to determine if property-price changes between 2000 and 2008 have been stronger in New Jersey's Transit Villages (as identified in 2008) than they have been elsewhere within the state, *ceteris paribus*. The main difference is that only one observation exists per municipality, rather than one for each year of the study. Hence, factors absorbed as fixed effects in the panel analyses are articulated, insofar as possible. This meant that details are needed on each municipality's typical property characteristics: the quality and quantity of its residential structure(s) and the nature of its lot sizes, ***q***; the demographic composition of its neighborhoods, ***n***; its access to major job and retail marketplaces, ***m***; the quantity and quality of the public services it provides, ***s***; the typical residence's share of the tax burden to pay for those services, ***t***; and the magnitude of demand pressures on the municipality's residential market during the study period relative to those engaged elsewhere in the state, ***d***.

Because the object of the analysis is identifying the determinants of property price change, the property and municipal characteristics should be evaluated both as a function of their initial state (in the year 2000) as well as a function of the change in the quantity/intensity and price of the characteristics between 2000 and 2008. For example, the magnitude of a particular property's price changes is a function of its initial price, the extent of investments that the owner has put into the property, and the change in tastes of consumers for existing housing attributes (which affects the relative price of the attributes). As in the case of the panel analysis a log-linear functional form was applied as has been suggested by (Cropper, Deck & McConnell 1988). As a result, the basic model applied was that shown below, where the notation detailed above includes both the state and change version of the characteristics.

$$\left[ln\left(P_{i2} - ln(P_{i1})\right)\right] = \beta_1 ln(P_{i1}) + \beta_2 q_i + \beta_3 n_i + \beta_4 m_i + \beta_5 s_i + \beta_6 t_i + \beta_7 d_i + \epsilon_i$$

This approach, of using the change in property values, has been applied by other studies, including (Chatman, Tulach & Kim under review, McDonald, Osuji 1995, McMillen, McDonald 2004, Goetzmann, Spiegel 1995).

Data

Our analysis strategy was designed to model housing prices based at the municipal level. This allows us to take advantage of municipal level features that are hypothesized to have an effect on housing values. Therefore, we collected relevant data at the level of the municipality over a number of years to produce a cross-sectional time-series data base for analysis. We also had some data that was only available as a cross-section which we also used in a cross-sectional analysis that could not take advantage of changes over time.

Table 2 provides a list of variables used in the models, along with sources, years available and any notes on the variables.

Table 2: Variables used in models

Variables	**Source**	**Years available**	**Notes**
Average residential sale value	NJ Department of the Treasury	1994-2008	Indexed using housing CPI for NYC and Philadelphia
Equalized housing value	NJ Department of the Treasury	1994-2008	Indexed using housing CPI for NYC and Philadelphia
Housing units	NJ Department of Labor and Workforce Development	2000-2008	
Murders and assaults	Federal Bureau of Investigation	1994-2008	75 missing municipalities
Effective tax rate	NJ Department of the Treasury	2000-2008	
Population density	NJ Department of Labor and Workforce Development, US Census for land area	2000-2008	
Average ridership per station in municipality	NJ TRANSIT, PATH, SEPTA, and PATCO	2000-2008	
Total average SAT score in municipality	NJ Department of Education	2002-2008	
NJ Assessment of Skills and Knowledge (NJ ASK)	NJ Department of Education	2003-2008	Not usable as time series, 116 missing municipalities
Geographic variables: distance to NYC and Philadelphia, and deviation off the NE corridor	Derived from GIS	Time-invariant	Deviation off the NE corridor derived from: $[(\text{Distance to NYC})^2 + (\text{Distance to Philadelphia})^2]^{1/2}$
Percent of land area undeveloped	NJ Department of Environmental Protection and the Center for Remote Sensing and Spatial Analysis at Rutgers University	2000	Based on GIS and satellite imagery
Median number of rooms per housing unit	US Census	2000	
Average residential lot size	US Census	2000	
Percent of housing units built before 1960	US Census	2000	
Percent of housing units that are seasonal	US Census	2000	
Percent of the total population that is between the ages of 3 and 18 years of age.	US Census	2000	

Crime data was available from the Federal Bureau of Investigation (FBI) at the municipal level. We included violent crime, murder (murder and non-negligent man-slaughter) and aggravated assault in our models. Municipalities with fewer than 10,000 residents tended not to have crime data available from the FBI database, thus we lose 75 of New Jersey's 566 municipalities in any analysis that includes this variable. None of these are Transit Village communities and none have rail stations, so we don't expect this omission to affect our results.

We collected two educational variables, SAT scores and the NJ ASK percent proficiency levels. These scores were averaged for all schools within a school district and associated with the appropriate municipalities. In order to gauge school quality within a municipality, school districts were mapped and assigned to the appropriate jurisdiction. When residents of municipalities send students to schools located outside its borders (to a regional school or through send/receive relationships) municipalities were associated with the appropriate district.

Data on the ridership from providers for each fixed transit station within the state were provided by NJ TRANSIT, PATH, SEPTA, and PATCO. These data were aggregated to the municipal location of the station and standardized (averaged) across the number of stations within the municipality.

Population estimates for municipalities were obtained from the NJ Department of Labor and Workforce Development. Land Area was obtained from the US Census. Population density was calculated for each municipality.

Information on tax rates is derived using the equalized tax rate. This is a tax rate that equalizes the relative assessment across municipalities. The state creates a statistically designed measure based on sales data to develop state equalization ratios. This ratio is then multiplied with the general tax rate to determine the equalized tax rate. Data were obtained from the NJ Department of the Treasury.

The property valuation is our key dependent variable. We use two different variables obtained from the NJ Department of the Treasury. One measure is the equalized value. This is an average of the preceding three years of the total aggregate equalized valuation by municipality. This also includes the assessed valuation of Class II railroad property. The objective of equalizing value is to adjust for any differences in assessment measures used by different municipalities. To obtain a per unit measure we divide by the total number of housing units in the municipality (obtained from the NJ Department of Labor and Workforce Development). We also used the average residential sale price of all units within a municipality. This averages the transactions that occurred within a given year and thus provides a measure of actual value. It may be somewhat biased downwards because of non-arms-length transactions, but assuming that this bias is the same across municipalities and years it should not affect our analysis.

Both measures of valuation are indexed using the Consumer Price Index for housing. For the north Jersey counties within the North Jersey Transportation Planning Authority region we use the regional index for the New York metropolitan area and for the south Jersey region (all the other counties) we use the regional index for the Philadelphia metropolitan region.

As we also estimated a cross-sectional model, we have data that is time-invariant and might also be associated with residential property values. These include geographical variables, such as the distance from the municipality centroid to both New York City and Philadelphia. From this we also calculated a variable to proxy for distance off of the Northeast Corridor (large following the rail line between Philadelphia and New York City). This was the $[(\text{Distance to NYC})^2 + (\text{Distance to Philadelphia})^2]^{1/2}$.

Land use and land cover data is a composite of 1995/97 land use/land cover analysis developed by the NJ Department of Environmental Protection and updated for 2000 using information developed by Richard Lathrop at The Center for Remote Sensing and Spatial Analysis at Rutgers University using satellite images. From this the undeveloped land variable is derived, less acreage acquired as open space, as a percentage of total acreage as of 2000 for each municipality.

Various data was compiled from the 2000 US Census. This included: Median number of rooms per housing unit for each municipality in 2000, average residential lot size in acres for each municipality in 2000, percentage of total housing units that were built prior to 1960 for each municipality in 2000, percentage of total housing units that are seasonal units for each municipality in 2000, percentage of the total population that is between the ages of 3 and 18 years of age for each municipality in 2000.

Analysis results

Cross-sectional time-series analysis

We initially estimate models using a simple fixed effects approach that includes dummy variables for all municipalities (less one) in the sample. Results are shown in Table 3 for estimates with both the equalized housing value and the average residential sale price as dependent variables. We use both dependent variables and also model the entire sample of municipalities plus only those with rail stations. The latter model helps to factor out any influence of higher housing prices from being near a rail station, as we cannot control for this other than through the fixed effects when using the full sample. We also tested whether a random effects specification might be appropriate, but the Hausman test rejected the random effects model.

Table 3: Fixed Effects Models

Dependent variable	**ln (equalized housing value, indexed)**	**ln (average residential sale value)**	**ln (equalized housing value, indexed)**	**ln (average residential sale value)**
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (equalized housing value, indexed)	0.652		0.603	
	(51.4)		(24.2)	
Lag of ln (average residential sale value)		0.406		0.279
		(24.6)		(8.59)
housing units (divided by1000)	0.00823	0.0300	0.00969	0.0386
	(1.88)	(4.36)	(1.31)	(3.47)
population density (divided by 1000)	0.0000658	-0.00924	-0.00494	-0.0223
	(0.011)	(-0.95)	(-0.55)	(-1.66)
Lag of total murders	-0.000606	-0.00105	-0.000727	-0.00178
	(-0.80)	(-0.88)	(-0.79)	(-1.28)
Effective tax rate	0.0157	0.0354	0.0450	0.0526
	(3.02)	(4.45)	(4.77)	(3.85)
Average ridership per station in municipality (divided by 1000)	0.00295	-0.000902	0.00212	-0.00223
	(2.17)	(-0.42)	(1.41)	(-0.99)
Total average SAT score in municipality	-0.000203	-0.000114	-0.000193	-0.0000713
	(-5.03)	(-1.78)	(-2.66)	(-0.65)
Transit Village dummy	**0.0200**	**0.0343**	**0.0280**	**0.0515**
	(1.70)	(1.86)	(2.28)	(2.79)
Constant	4.058	6.600	4.700	8.137
	(26.3)	(31.3)	(15.6)	(20.3)
Number of Observations	3735	3719	1031	1023
R^2	0.942	0.336	0.878	0.000387
δ	0.969	0.970	0.984	0.989

Year effects omitted for brevity

Two issues arise in these estimates. First, the use of a lagged dependent variable potentially leads to biased and inconsistent coefficient estimates. This is due to the lagged dependent variable potentially being correlated with the fixed effects. Another issue with these data is that the panel exhibits a high degree of serial correlation in the error term, as shown by the value of δ being near 1. This implies that we need to correct for serial correlation as these estimates are likely inefficient. As can be seen our key variable of interest, the Transit Village dummy is statistically significant (at 90% levels and 95% levels when only rail municipalities are included in the sample). The potential bias, inconsistency, and inefficiency of the estimate, however, may make this result unreliable.

Dynamic panel models (i.e. with a lagged dependent variable) are typically estimated using the Generalized Methods of Moment (GMM) estimator to correct for inconsistency and bias in the estimates. We estimated the system GMM model proposed by (Arellano, Bover 1995) and (Blundell, Bond 1998) and results are shown in Table 4.[3] This approach has the additional advantage of specifying instruments for the independent variables. This is done by using both lags and differences of the independent variables as instruments in the model. The use of instruments allows one to estimate a causal model, rather than just determining associations between the variables. GMM models, however, tend to be quite unstable and can give very different results depending on the specification of the lag structure. Our estimates assume that all lags and differences are used as instruments, rather than using ad-hoc specifications (Roodman 2009). However, we find that our instruments are overidentified as indicated by the Sargan test, which makes them invalid. The Arellano-Bond AR2 test evaluates the correlation between the difference of the residuals, which is used to determine whether the levels are serially correlated. In our model this does not seem to be a problem so we can reject the null hypothesis of serial correlation in the instruments. We also estimated the System GMM model with the

[3] One approach to examine the bias in a fixed effect estimate is to estimate a GMM model and also a simple ordinary least squares (OLS) model with the data. The GMM parameter estimate for the lagged dependent variable should fall between the two estimates, being less than the OLS estimate and greater than the fixed effects estimate. We found this to be the case but omit the OLS model for brevity.

Windmeijer correction to the covariance matrix in a two-step model (Table 5) (Windmeijer 2005). These provide more robust standard errors, but we still have the problem of instrument overidentification.

The GMM approach to dynamic panel models is increasingly seen as unreliable and potentially can lead to misleading results (Roodman 2009). While it solves one estimation problem, the existence of invalid instruments potentially makes the overall results worse than trying to control for the bias and inconsistency of a fixed effects model with a dynamic lag. Despite this, the GMM model does provide more theoretically consistent results on most of the variables than our other models, but the Transit Village dummy variable is not statistically significant.

With these estimation problems in mind we use a fixed effects method with a correction for serial correlation within panels. This provides estimates using the Prais-Winsten method. These results are shown in Table 6. In these models, we find that the Transit Village dummy variable exhibits a small but statistically significant effect on housing valuations, when measured by average residential sale prices, but not by equalized housing valuations. However, for both these models the R^2 value is very low, suggesting little explanation for the variance in average residential sale price.

The values of other coefficient estimates in the model do not conform with our theoretical expectations. For example, we would expect population density to be associated with higher housing values, but we find it has a negative effect (and significant at the 95% confidence level for our rail station municipality sample). Those areas with higher population density may tend to be either higher income (e.g. parts of Jersey City along the Hudson River) or lower income (e.g. other parts of Jersey City). Increased density is a response to high land values leading to high-rise development or multi-family units, but this also partially mitigates the cost of the units.

Table 4: System Generalized Method of Moments model

Dependent variable	ln (equalized housing value, indexed)	ln (average residential sale value)	ln (equalized housing value, indexed)	ln (average residential sale value)
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (equalized housing value, indexed)	0.960		0.986	
	(235.1)		(218.8)	
Lag of ln (average residential sale value)		0.917		0.952
		(139.2)		(85.9)
housing units (divided by1000)	-0.000581	-0.000446	-0.000176	-0.000170
	(-2.95)	(-1.37)	(-0.68)	(-0.39)
population density (divided by 1000)	-0.0000951	0.00207	-0.000187	0.000525
	(-0.39)	(4.60)	(-0.59)	(0.93)
Lag of total murders	-0.00173	-0.00117	-0.00132	-0.000970
	(-5.78)	(-2.30)	(-3.93)	(-1.69)
Effective tax rate	-0.0422	-0.0614	-0.0122	-0.0276
	(-17.3)	(-14.6)	(-3.27)	(-4.03)
Average ridership per station in municipality (divided by 1000)	0.00129	0.000496	0.00105	0.000462
	(4.81)	(1.10)	(3.39)	(0.89)
Total average SAT score in municipality	-0.000206	-0.0000736	-0.000162	-0.0000751
	(-9.31)	(-2.16)	(-6.11)	(-1.57)
Transit Village dummy	**-0.00874**	**0.00135**	**0.00284**	**0.00386**
	(-1.40)	**(0.13)**	**(0.41)**	**(0.33)**
Constant	0.840	1.318	0.348	0.679
	(12.7)	(11.6)	(6.29)	(5.35)
Number of Observations	3735	3719	1031	1023
Sargan (p)	0.000	0.000	0.000	0.000
AB AR1 (p)	0.000	0.000	0.000	0.000
AB AR2 (p)	0.492	0.636	0.713	0.134

Year effects omitted for brevity

Table 5: System Generalized Method of Moments model with Windmeijer's finite-sample correction for the two-step covariance matrix

Dependent variable	**ln (equalized housing value, indexed)**	**ln (average residential sale value)**	**ln (equalized housing value, indexed)**	**ln (average residential sale value)**
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (equalized housing value, indexed)	0.960		0.987	
	(78.7)		(113.2)	
Lag of ln (average residential sale value)		0.917		0.954
		(57.5)		(35.1)
housing units (divided by1000)	-0.000590	-0.000451	-0.000164	-0.000243
	(-1.65)	(-0.92)	(-0.63)	(-0.63)
population density (divided by 1000)	-0.000110	0.00208	-0.000119	0.000752
	(-0.29)	(2.20)	(-0.32)	(0.98)
Lag of total murders	-0.00174	-0.00117	-0.00129	-0.000950
	(-3.30)	(-1.34)	(-3.10)	(-1.29)
Effective tax rate	-0.0422	-0.0612	-0.0122	-0.0279
	(-5.95)	(-5.54)	(-2.74)	(-2.20)
Average ridership per station in municipality (divided by 1000)	0.00130	0.000495	0.00101	0.000449
	(2.35)	(0.50)	(3.30)	(0.88)
Total average SAT score in municipality	-0.000207	-0.0000731	-0.000161	-0.0000796
	(-4.82)	(-1.32)	(-4.14)	(-1.15)
Transit Village dummy	**-0.00881**	**0.00119**	**0.00259**	**0.00574**
	(-1.06)	**(0.100)**	**(0.42)**	**(0.70)**
Constant	0.744	1.327	0.338	0.651
	(1.63)	(4.81)	(3.65)	(2.09)
Number of Observations	3735	3719	1031	1023
Sargan (p)	0.000	0.000	0.000	0.000
AB AR1 (p)	0.00000193	0.000	0.0236	0.000908
AB AR2 (p)	0.516	0.737	0.718	0.442

Year effects omitted for brevity

Table 6: Fixed Effects with AR1 correction

Dependent variable	ln (equalized housing value, indexed)	ln (average residential sale value)	ln (equalized housing value, indexed)	ln (average residential sale value)
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (equalized housing value, indexed)	0.358		0.177	
	(22.6)		(5.67)	
Lag of ln (average residential sale value)		0.0519		-0.0454
		(2.58)		(-1.22)
housing units (divided by1000)	0.0198	0.0465	0.0182	0.0490
	(2.74)	(3.92)	(1.40)	(2.74)
population density (divided by 1000)	-0.00707	-0.0227	-0.0322	-0.0515
	(-0.93)	(-1.79)	(-2.27)	(-2.60)
Lag of total murders	-0.000441	-0.00119	-0.000273	-0.00150
	(-0.57)	(-0.90)	(-0.32)	(-1.06)
Effective tax rate	0.00734	0.0211	0.0530	0.0326
	(1.13)	(1.98)	(3.73)	(1.62)
Average ridership per station in municipality (divided by 1000)	0.00369	-0.000699	0.00426	-0.000471
	(2.22)	(-0.25)	(2.12)	(-0.15)
Total average SAT score in municipality	-0.0000632	-0.0000614	-0.0000199	-0.0000742
	(-1.67)	(-0.95)	(-0.32)	(-0.69)
Transit Village dummy	**0.0117**	**0.0539**	**0.0154**	**0.0615**
	(0.74)	**(2.03)**	**(0.90)**	**(2.32)**
Constant	-0.678	10.89	9.552	12.09
	(-4.51)	(61.8)	(44.1)	(35.9)
Number of Observations	3266	3252	896	889
R^2	0.303	0.000735	0.0473	0.0147
δ	0.325	0.302	0.449	0.309
Baltagi-Wu LBI	2.095	2.108	2.127	2.090
Bhargava DW	1.725	1.738	1.725	1.739

Year effects omitted for brevity

The effective tax rate is included as we assume that higher tax rates will reduce the value of property. However, we reject this hypothesis as we actually find an opposite and significant effect. Higher tax rates appear to be associated with higher property values. A possible explanation is that those areas that accept higher taxes are areas with higher incomes and property values.

Our expectation is that a larger housing supply should decrease housing values, but this may be partly an issue of timing. We examined whether a lagged housing supply variable in the model would provide a negative coefficient, but found that it was still positive and statistically significant. Another possible explanation is that this could be due to an increase in housing supply representing an increase in housing quality, as these would most likely be newly constructed units that may command a premium price.

To model crime we include the total murders within the municipality, lagged by one year. The reason for including total murders, rather than the murder or assault rate, is that this is more likely to affect perceptions of the desirability of a municipality. As an example, while Camden typically has a high number of murders, in some years its rate of murders and assaults is not as high as some other areas (e.g. Franklin Township in Somerset County). It is possible that in some higher crime areas such as Camden assaults are under-reported, especially as many of these are likely to be domestic assaults, while in more suburban municipalities, these are more likely to be reported. We find that our lagged total murder variable is not statistically significant.

We also estimated additional models with the lagged murder and assault rate and found this be negative and statistically significant in our residential sale model (see Table 7 and Table 8), but insignificant in the model with equalized valuations. Other variables in these models are relatively robust compared to the model in Table 6 suggesting this might be a better measure of crime than the total number of murders.

Table 7: Additional models, Fixed Effects with AR1 correction

Dependent variable	**ln (equalized housing value, indexed)**	**ln (equalized housing value, indexed)**	**ln (equalized housing value, indexed)**	**ln (equalized housing value, indexed)**
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (equalized housing value, indexed)	-0.380	0.363	0.694	0.185
	(-49.4)	(22.9)	(32.1)	(5.93)
Transit Village dummy	**0.0186**	**0.0118**	**0.0347**	**0.0155**
	(0.75)	**(0.75)**	**(2.79)**	**(0.91)**
housing units (divided by1000)		0.0194		0.0178
		(2.70)		(1.39)
population density (divided by 1000)		-0.00710		-0.0318
		(-0.94)		(-2.26)
Lag of assault and murder rate		0.182		0.144
		(0.96)		(0.80)
Effective tax rate		0.00751		0.0539
		(1.16)		(3.83)
Total average SAT score in municipality		-0.0000654		-0.0000247
		(-1.73)		(-0.40)
Average ridership per station in municipality (divided by 1000)		0.00358		0.00418
		(2.16)		(2.08)
Constant	15.75	-0.676	3.476	9.464
	(963.8)	(-4.44)	(14.6)	(43.4)
Number of Observations	5595	3265	1064	896
R^2	0.560	0.316	0.989	0.0477
Δ	0.814	0.321	0.0294	0.442
Baltagi-Wu LBI	2.093	2.101	2.160	2.145
Bhargava DW	1.412	1.731	1.959	1.741

Year effects omitted for brevity

Table 8: Additional models, Fixed Effects with AR1 correction

Dependent variable	**ln (average residential sale value)**	**ln (average residential sale value)**	**ln (average residential sale value)**	**ln (average residential sale value)**
Sample used	**All municipalities**		**Rail station municipalities**	
Lag of ln (average residential sale value)	0.596	0.0363	0.421	-0.0503
	(59.2)	(1.81)	(14.1)	(-1.36)
Transit Village dummy	**0.0362**	**0.0525**	**0.0591**	**0.0609**
	(2.63)	**(1.97)**	**(1.81)**	**(2.30)**
housing units (divided by1000)		0.0448		0.0445
		(3.72)		(2.51)
population density (divided by 1000)		-0.0243		-0.0539
		(-1.90)		(-2.71)
Lag of assault and murder rate		-11.06		-15.78
		(-5.30)		(-2.85)
Effective tax rate		0.0189		0.0333
		(1.76)		(1.65)
Total average SAT score in municipality		-0.0000521		-0.0000662
		(-0.81)		(-0.62)
Average ridership per station in municipality (divided by 1000)		-0.000914		-0.000691
		(-0.33)		(-0.22)
Constant	4.480	11.10	6.737	12.25
	(39.7)	(64.5)	(39.3)	(0.21)
Number of Observations	7213	3251	1087	889
R^2	0.932	0.000503	0.923	0.0445
δ	-0.00816	0.318	0.507	0.316
Baltagi-Wu LBI	2.199	2.100	2.172	2.091
Bhargava DW	2.007	1.728	1.866	1.736

Year effects omitted for brevity

The school quality variable, the total SAT scores for the municipality, is in most cases statistically insignificant; and in some models actually negative and with a small level of statistical significance. This is unexpected as we hypothesized that better school quality would increase housing values. One explanation is that SAT scores for a given school are relatively stable from year to year; changes may take much more than a year to be at equilibrium with housing prices. The average station ridership by municipality is statistically significant in our equalized housing value models (see Table 6 and Table 8), but not when our dependent variable is the average residential sale price.

As mentioned previously, each table also includes models that have only municipalities with rail stations. This was done as it is possible that the Transit Village dummy was simply picking up the effect of having a rail station, rather than the effect of the Transit Village initiative. We could not control for the presence of a rail station as for most municipalities there was no change over the time series in the number of stations (minor changes did occur, in particular the opening of the RiverLINE in 2004 and some extensions to the Hudson-Bergen Light Rail). Overall, we do not find major differences in the estimate for our Transit Village dummy variable. The model with AR1 corrections (Table 6) is very robust with the average residential sale price model having similar parameter values on the transit dummy variable, despite the different and smaller size of the sample with rail stations.

To further test for the robustness of our result, we estimate models that omit some variables in Table 7 (for the equalized housing value) and Table 8 (for the average residential sale price). These are estimated using the fixed effects model with a correction for autocorrelation. First we omit all other variables and include just the Transit Village dummy and year fixed effects. We find that the Transit Village dummy is statistically significant when the average residential sale price is used as the dependent variable (Table 8); at the 95% confidence level when all municipalities are included and 90% when only rail station municipalities are included. For the equalized housing valuation model we find that the Transit Village dummy is only statistically significant in the model with just rail station municipalities (Table 7).

Overall the cross-sectional time-series analyses suggest that there is some association between being designated as a Transit Village and having higher residential property values. However as the discussion above has shown, when additional covariates are included in the model, this effect is less apparent, and we are unable to determine whether there is a causal effect. Our preferred model is the fixed effects model with a correction for autocorrelation, and while these tend to show a significant effect for the Transit Village dummy, when the average residential sale price is used, the R^2 values drop substantially, suggesting that the overall fit of the model is not good.

To further interpret these findings we also graphically examined the trend in average residential sales value for all the Transit Villages in our sample relative to the average residential sales price for that region of the state (see

Figure 2 for North Jersey, Figure 3 for Central Jersey, and Figure 4 for South Jersey). While the year that each Transit Village was designated varies (**Error! Reference source not found.**), we see that there is substantial variation in the relative changes in average prices. All the graphs are indexed to 0 along the vertical axis and the lines show the change relative to the regional average. For the North Jersey Transit Villages (

Figure 2), the majority of the Transit Village municipalities experienced price appreciation greater than the regional average, with only few exceptions (Netcong, Cranford); Orange underperforms until the final two years of our data, and is the most recent municipality to be designated a Transit Village, only in 2009, so this might represent and anticipatory price increase, or other factors such as enhanced planning or development that proceed Transit Village designation. The municipalities in Central Jersey underperform the regional average (with the exception of Belmar, designated a Transit Village in 2003 and seeing a large increase the prior year). The South Jersey municipalities, which tend to have lower income populations, also tend to underperform (the one exception being Pleasantville, which has a small increase in the last two years of the data – this cannot be attributed to a recent Transit Village designation as Pleasantville became a Transit Village in 1999). While these underperforming trends in Central and South Jersey are surprising, it may be that these municipalities performed better than they would have if they had not been designated Transit Villages. It is also possible, that commercial real estate prices have increased, but we were unable to analyze this.

Figure 2: Indexed average residential sales value, North Jersey Transit Villages relative to North Jersey average

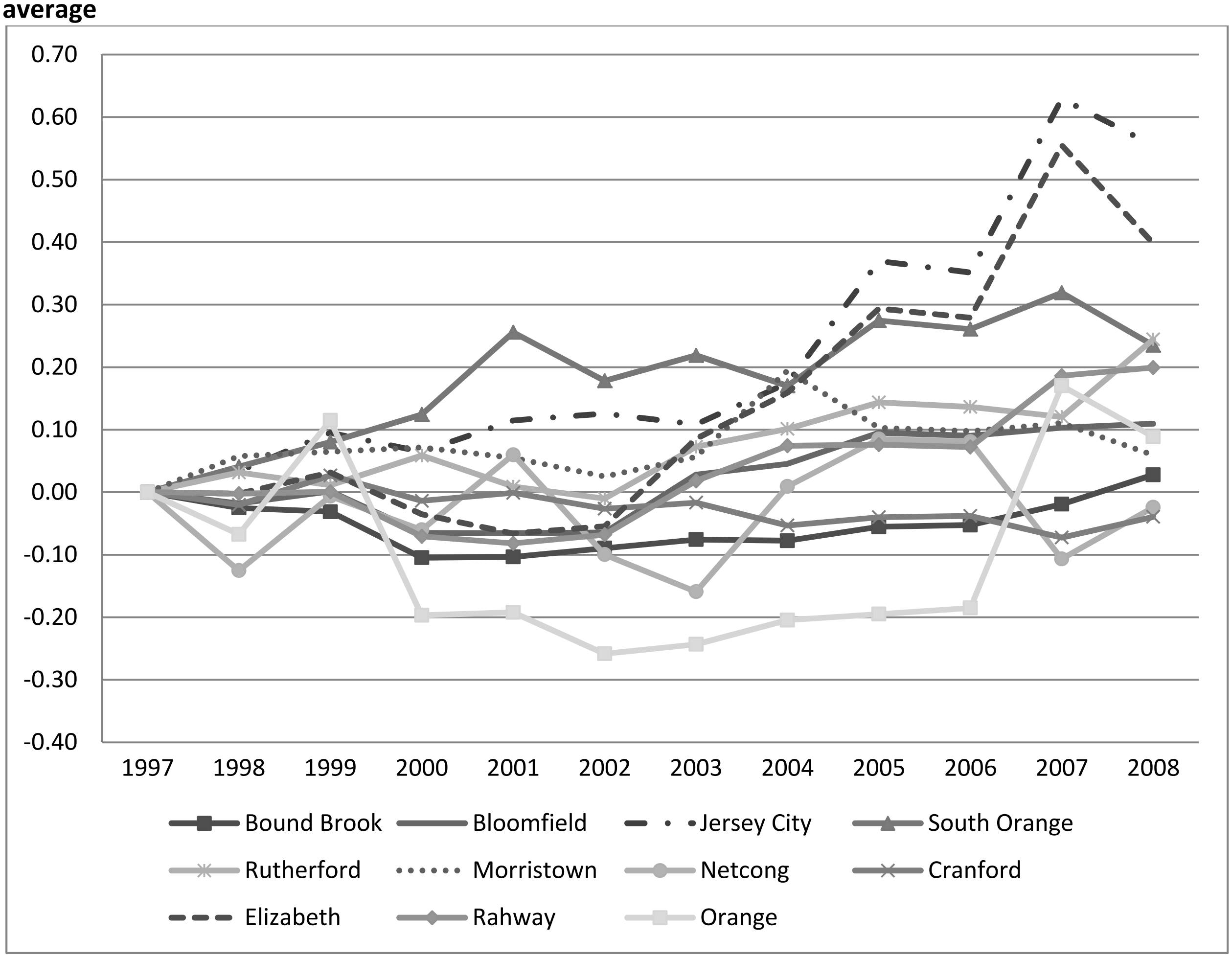


Figure 3: Indexed average residential sales value: Central Jersey Transit Villages relative to Central Jersey average

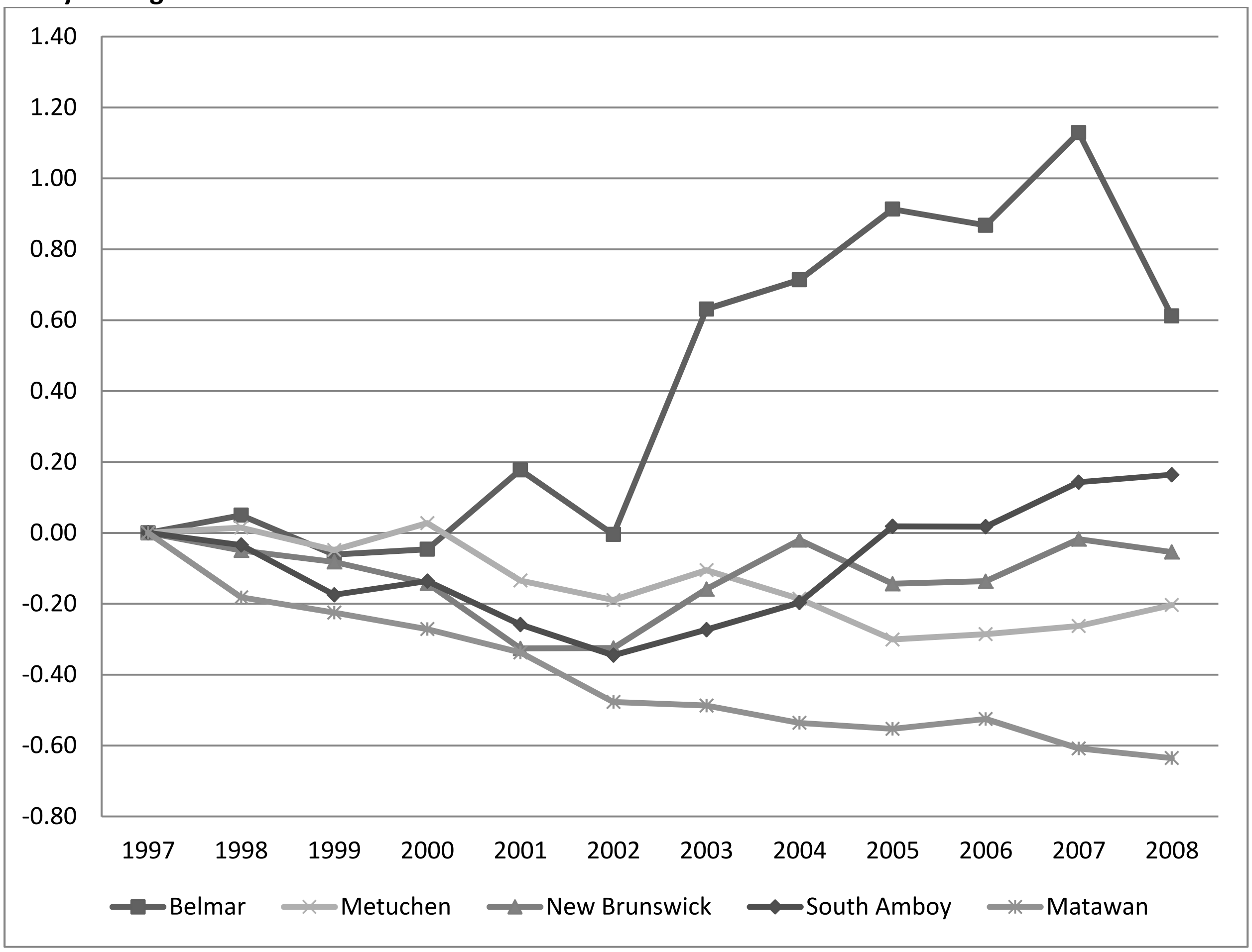
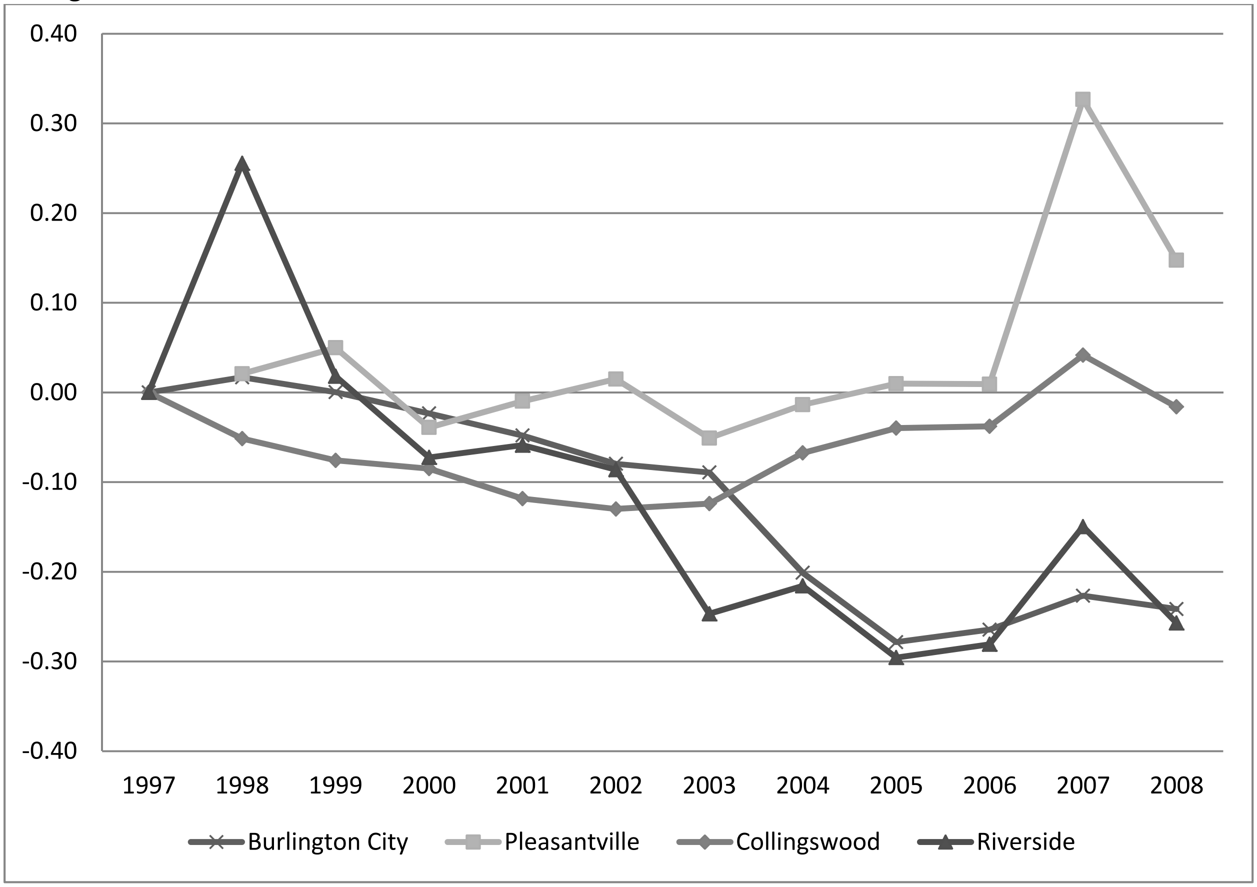


Figure 4: Indexed average residential sales value: South Jersey Transit Villages relative to South Jersey average



Cross-sectional analysis

The cross-sectional residential price change was modeled with the same dependent variables as the panel data analysis, but modeled as the change in value between 2000 and 2008. As there is some possibility that the Transit Village variable is endogenous, that is that being designated a Transit Village occurs when planning capacity is sufficient to implement changes, we also test an instrumental variable model. We noticed that Transit Village designation tended to occur in fairly densely populated municipalities that seemed to be fairly savvy with respect to town planning. Hence, we used as instruments for the Transit Village variable the log of municipal population density and the municipality decision to establish its own ordinance for historic preservation.

As can be seen in Table 9, Table 10, and Table 11, the only model that showed Transit Villages to have a statistically significant effect on property values was with the equalized assessed property values without instruments. Our panel data analysis, on the other hand, found the other dependent variable, average residential sales price, to be more likely to give a statistically significant effect. According to the results of this model, New Jersey's Transit Villages had an appreciable effect on assessed values between 2000 and 2008. In the alternative models (the instrumented version of the average residential sales model is not displayed for brevity), the Transit Village variable is not at all close to being statistically significant. The instrumental variable regression provides a good Sargan test suggesting the model is not overidentified, but the instruments remain weak[4], which can cause estimation problems.

We focus our examination of results for control variables upon those in Table 9, which displays the most positive results for New Jersey's Transit Villages. Most of these results meet our theoretical expectations. With regard to housing attributes ***q***, we note that a greater share of seasonal housing units tended to improve rates of appreciation in New Jersey and that more rooms per unit, larger shares of older housing stock, and larger than average parcel sizes tended to dampen the ability of residential properties to appreciate during the study period in New Jersey. Municipalities with higher housing unit densities also yielded higher appreciation rates. Of these, only the value-dampening effect of larger parcel sizes appears somewhat perverse. Of course, this variable could also proxy for suburban locations in close proximity to the state's central cities.

For neighborhood attributes ***n***, the municipality poverty rate and share of population that is school-aged had positive effects. But a high share of population with minority status, presence of a

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[4] We suspect the "weakness" stems from our assumption that a town's enactment of a "historic ordinance" would suffice as a proxy for savvy planning. It turned out that not all of the Transit Villages had a historic ordinance. Still, no other single objective indicator of "savvy planning" at our immediate disposal proved as successful in producing an instrument that was not overidentified.

national historic district, and population density had deleterious effects on appreciation rates. Of these, the dampening effect of a national historic district was unexpected given findings from many studies of residences outside of New Jersey using property-level data. Perversely, it could be that those areas that are in need of economic development find a way to become a national historic district as a means to enhance value or at least development. While a positive effect of low poverty rates might be somewhat unexpected, it undoubtedly is displaying a convergence effect: that is, the parameter for poverty rates, rather than that for low property values, shows that properties with lower values tend to appreciate percentagewise more rapidly than do properties with higher values.

The market variables ***m*** show more agreement with expectations. Homes further from old urban cores tended to appreciate more. Being away from the main New York-Philadelphia corridor also was associated with lower appreciation rates as well. Still, homes closer to New York City did not appreciate as quickly as those further from it. Finally, municipalities with a PATH station tended to have higher than expected appreciation rates, even after omitting Jersey City from the analysis. But those with a PATCO or NJ TRANSIT commuter rail station had appreciation rates that were not superior to those without them, after controlling for all other cross-sectional variables.

Public services ***s*** was strictly measured in the form of education—SAT verbal scores and math proficiency in junior high schools. Junior high school math proficiency had no statistically significant bearing on appreciation rates. But area municipalities with students who attained higher than average SAT verbal scores tended to have properties that did not appreciate very rapidly. Like poverty rates, this latter effect may also be one of convergence since SAT scores are perhaps the single-best known measure of school quality as perceived by homeowners and they are fairly stable over time. Hence, places with higher than average SAT scores tend to have higher property values to begin with. This may also explain the lack of statistical significance for this variable in the cross-sectional time-series analysis.

Table 9: Log-Linear regression of the determinants of change in the indexed average equalized property value for New Jersey municipalities between 2000 and 2008

	Coefficient	t-test
Constant	0.70466*	(2.28)
2008 Transit Village	**0.07312***	**(2.41)**
Average equalized assessed property value in 2000	0.01161	(0.81)
Distance to New York	-0.00197	(-1.77)
Square of the Distance to New York	0.00002*	(2.30)
Log of the sum of squared distances to both New York and Philadelphia	-0.12363**	(-2.93)
Log of the Distance to the closest CBD	0.04786***	(3.85)
% of 2000 population school-aged	0.00666***	(4.13)
% of 2000 housing stock seasonal	0.00432***	(8.43)
Rooms per unit 2000	-0.0075	(-0.86)
Density of residential units 2000	0.00002**	(2.87)
Change in unit density 2000-2008	-0.00003	(-0.43)
Log of housing density 2000	0.03100**	(2.66)
Average residential parcel size in 2000	-0.04662**	(-3.00)
% of homes in 2000 built before 1960	-0.00163***	(-4.60)
Percent of land area undeveloped in 2000	0.00102	(1.94)
% of revenues from state in 1990	-0.00553***	(-3.32)
Tax rate in 2000	-0.00259	(-0.70)
Tax rate 2008/tax rate 2000	-0.00988**	(-3.18)
Verbal SAT score in 2001	-0.00076***	(-3.65)
Change in average Verbal SAT score 2001-2008	-0.00068	(-1.93)
% of student proficient in the ASK4 math test in 2000	0.00155	(1.65)
Change in % ASK4 math test proficiency 2000-2008	0.00023	(0.34)
Presence of PATH station	0.18648**	(2.73)
Presence of PATCO station	0.02031	(0.37)
Presence of NJ TRANSIT commuter rail station	-0.00603	(-0.41)
Presence of a historic district	-0.07771**	(-2.99)
A Certified Local Government	0.08184*	(2.54)
Population density^2	-8.30e-11	(-1.96)
% of population Black in 2000	-0.11731	(-1.87)
% of population Asian in 2000	-0.25567	(-1.88)
% of population Hispanic/Latino in 2000	0.10982	(1.32)
Poverty rate in 1999	0.00344*	(2.05)
R^2	0.473	
N	514	

Tax burden ***t*** results met expectations. Municipalities with relatively high and rapidly rising tax rates tended to have home values that rose less quickly. Also municipalities that were able to secure large shares of funding from the state—those that tended to have relatively poor tax bases—tended to grow more slowly.

Finally demand-based pressures ***d***, tended to show no effect at all. That is, the share of land in the municipality that was undeveloped and the change in housing unit density had no systematic effect at all on residential appreciation rates in New Jersey from 2000-2008.

In sum the cross-sectional analysis reveals some evidence that there is an association between Transit Village designation and residential property values, and it is a positive one. Still, this finding is not robust to the use of more sophisticated statistical approaches or to the use of residential property sales prices, as opposed to indexed equalized assessed values (although the former gave better results in our cross-sectional time-series analysis). The overall implication is that, while residential properties in New Jersey's Transit Villages may have appreciated more than they did elsewhere in the state, the rises may have been due to characteristics of the transit-village municipalities prior to the actual designation. That is, the density of the municipalities and the forward-looking character of their policymakers that enabled their designation as Transit Villages may well have been the root cause of any growth in home prices that might be observed, rather than the privilege and rewards of designation itself.

Table 10: Log-Linear regression of the determinants of change in the indexed average equalized property value for New Jersey municipalities between 2000 and 2008 (with Transit Village binary variable instrumented)

	Coefficient	t-test
Constant	1.14942*	(2.42)
2008 Transit Village	**-0.36334**	**(-1.18)**
Average equalized assessed property value in 2000	-0.00187	(-0.10)
Distance to New York	-0.00273	(-1.96)
Square of the Distance to New York	0.00003*	(2.36)
Log of the sum of squared distances to both New York and Philadelphia	-0.17216**	(-2.89)
Log of the Distance to the closest CBD	0.05453***	(3.61)
% of 2000 population school-aged	0.00811***	(3.82)
% of 2000 housing stock seasonal	0.00460***	(7.36)
Rooms per unit 2000	-0.00755	(-0.75)
Density of residential units 2000	0.00002	(1.67)
Change in unit density 2000-2008	0.00004	(0.38)
Log of housing density 2000	0.02837*	(2.09)
Average residential parcel size in 2000	-0.04093*	(-2.22)
% of homes in 2000 built before 1960	-0.00107	(-1.88)
Percent of land area undeveloped in 2000	0.00071	(1.10)
% of revenues from state in 1990	-0.00537**	(-2.79)
Tax rate in 2000	-0.00431	(-0.96)
Tax rate 2008/tax rate 2000	-0.00731	(-1.82)
Verbal SAT score in 2001	-0.00103***	(-3.35)
Change in average Verbal SAT score 2001-2008	-0.00061	(-1.48)
% of student proficient in ASK4 math test in 2000	0.00206	(1.80)
Change in % ASK4 math test proficiency 2000-2008	0.0003	(0.39)
Presence of PATH station	0.25323**	(2.76)
Presence of PATCO station	0.08569	(1.10)
Presence of NJ TRANSIT commuter rail station	0.03547	(1.05)
Presence of a historic district	-0.05301	(-1.53)
A Certified Local Government	0.05433	(1.29)
Population density^2	-8.30e-11	(-1.84)
% of population Black in 2000	-0.09136	(-1.22)
% of population Asian in 2000	-0.24089	(-1.53)
% of population Hispanic/Latino in 2000	0.09701	(1.01)
Poverty rate in 1999	0.00437*	(2.13)
R^2	0.246	
N	514	
Sargan test	0.603	

Table 11: Log-Linear regression of the determinants of change in average residential property sales price for New Jersey municipalities between 2000 and 2008

	Coefficient	**t-test**
Constant	5.97434***	(5.96)
2008 Transit Village	**0.047**	**(0.54)**
Average property price in 20000	-0.46385***	(-7.61)
Log of the Distance to New York	-0.18277***	(-4.27)
Log of the sum of squared distances to both New York and Philadelphia	0.04794	(0.52)
Log of the Distance to the closest CBD	0.19552***	(5.18)
% of 2000 population school-aged	0.00173	(0.36)
% of 2000 housing stock seasonal	-0.00233	(-1.06)
Rooms per unit 2000	0.02642	(0.99)
Density of residential units 2000	-0.00003	(-1.54)
Change in unit density 2000-2008	0.00040*	(2.02)
Log of housing density 2000	0.06278	(1.76)
Average residential parcel size in 2000	0.05006	(1.07)
% of homes in 2000 built before 1960	-0.00200*	(-1.97)
Percent of land area undeveloped	-0.00106	(-0.72)
% of revenues from state in 1990	-0.00639	(-1.25)
Tax rate in 2000	-0.00556	(-0.52)
Tax rate 2008/tax rate 2000	-0.01722	(-1.93)
Verbal SAT score in 2001	-0.00054	(-0.85)
Change in average Verbal SAT score 2001-2008	-0.00206*	(-1.97)
% of student proficient in ASK$ math test 2000	-0.00008	(-0.03)
Change in % ASK4 math test proficiency 2000-2008	-0.00437*	(-2.25)
Presence of Path station	0.08102	(0.41)
Presence of PATCO station	0.07201	(0.46)
Presence of NJ TRANSIT commuter rail station	-0.05077	(-1.19)
Presence of a historic district	-0.18435*	(-2.49)
A Certified Local Government	0.24786**	(2.67)
Population density^2	-8.95e-11	(0.25)
% of population Black in 2000	-0.30543	(-1.70)
% of population Asian in 2000	-0.29431	(-0.75)
% of population Hispanic/Latino in 2000	0.2784	(1.16)
Poverty rate in 1999	0.00104	(0.21)
R^2	0.262	
N	505	

Discussion and Conclusions

Our analyses of residential property values find some limited evidence of an association between Transit Village designation and increases in property values. While our original intent was to develop a causal model, using an instrumental variable or GMM approach, we found that it was not possible to find a suitable instrument to represent the designation of a Transit Village. It is possible that this is not an endogenous effect; that is, the designation may be exogenous to the value of property. Anecdotal evidence suggests that at times political factors may result in a designation rather than any conditions (such as enhanced planning) that may precede Transit Village designation (Pleasantville and the RiverLINE stations represent political attempts to spur development, rather than development preceding the designation). We find statistically significant associations in some of the cross-sectional time-series models, as well as one of the cross-sectional analysis, but our instrumental variable and GMM models fail to provide good instruments. Our graphical analysis suggests that in some Transit Villages there is an increase in property values, although not necessarily linked to when the municipality became a Transit Village.

While not discussed in detail here, we examined six Transit Village case studies.[5] From this we found that there is a wide variation in what the Transit Villages have accomplished in terms of development. There is some evidence that those municipalities that have taken steps to encourage transit-oriented development, either through pro-active planning, or professional capabilities, have seen increases in the value of residential properties. Being designated a Transit Village may be simply an indicator of how these municipalities are able to take advantage of opportunities provided by the state.

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[5] Belmar, Bound Brook, Burlington City, Journal Square (Jersey City), Metuchen, and Pleasantville were investigated in more detail. A full report on this is available from the authors.

The Transit Villages in our data represent many different characteristics. One is obviously accessibility, but these areas also embody amenity characteristics of transit-oriented development, or at least may be planning them. Thus, we are to a large extent capturing difficult to measure factors in this evaluation of Transit Villages; both in terms of the variety of what each municipality has accomplished and what the planning capacity within each municipality may be. Thus, to some extent, while our modeling work has many caveats, the fact that we do find some associations between Transit Village designations and an increase in property values, suggest that these difficult to measure factors may be having a positive influence in these municipalities.

Acknowledgements

This research was funded by the New Jersey Association of REALTORS Governmental Research Foundation. All views and opinions are solely those of the authors and to not represent the policy or positions of the funding agency. We thank research assistance provided by May Ng, Matthew Kabak, Matthew Ward, Jennifer Rovito, Nicholas Klein, and Garrett Hincken.

References

Alonso, W. 1964, *Location and land use,* Harvard Univ. Press.

Arellano, M. & Bover, O. 1995, "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics,* vol. 68, no. 1, pp. 29-51.

Bartholomew, K. & Ewing, R. 2010, *Hedonic Price Effects of Pedestrian-and Transit-Designed Development*, Working paper edn, University of Utah.

Blundell, R. & Bond, S. 1998, "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics,* vol. 87, no. 1, pp. 115-143.

Bowes, D.R. & Ihlanfeldt, K.R. 2001, "Identifying the Impacts of Rail Transit Stations on Residential Property Values", *Journal of Urban Economics,* vol. 50, no. 1, pp. 1-25.

Chatman, D.G., Tulach, N.G. & Kim, K. under review, "Evaluating the economic impacts of light rail by measuring home appreciation: A first look at New Jersey's River Line", *Urban Studies,* .

Cropper, D., Deck, L. & McConnell, K.E. 1988, "On the choice of functional forms for hedonic price functions", *Review of Economics and Statistics,* vol. 70, pp. 668–675.

Debrezion, G., Pels, E. & Rietveld, P. 2007, "The impact of railway stations on residential and commercial property value: a meta-analysis", *The Journal of Real Estate Finance and Economics,* vol. 35, no. 2, pp. 161-180.

Gibbons, S. & Machin, S. 2005, "Valuing rail access using transport innovations", *Journal of Urban Economics,* vol. 57, no. 1, pp. 148-169.

Goetzmann, W.N. & Spiegel, M. 1995, "Non-temporal components of residential real estate appreciation", *The review of economics and statistics,* vol. 77, no. 1, pp. 199-206.

Kim, K. & Lahr, M.L. 2010, *The Impact of the Hudson-Bergen Light Rail on Property Value Change*, Working paper edn, Rutgers University, New Brunswick, NJ.

McDonald, J.F. & Osuji, C.I. 1995, "The effect of anticipated transportation improvement on residential land values", *Regional Science and Urban Economics,* vol. 25, no. 3, pp. 261-278.

McMillen, D.P. & McDonald, J. 2004, "Reaction of House Prices to a New Rapid Transit Line: Chicago's Midway Line, 1983–1999", *Real Estate Economics,* vol. 32, no. 3, pp. 463-486.

Plaut, P.O. & Boarnet, M.G. 2003, "New Urbanism and the value of neighborhood design", *Journal of Architectural and Planning Research,* vol. 20, no. 3, pp. 254-265.

Roodman, D. 2009, "A Note on the Theme of Too Many Instruments*", *Oxford Bulletin of Economics and Statistics,* vol. 71, no. 1, pp. 135-158.

Song, Y. & Knaap, G.J. 2003, "New urbanism and housing values: a disaggregate assessment", *Journal of Urban Economics,* vol. 54, no. 2, pp. 218-238.

Vessali, K. 1996, "Land use impacts of transit: A review of the empirical literature", *Berkeley Planning Journal,* vol. 11, pp. 71-105.

Voith, R. 1993, "Changing capitalization of CDB-oriented transportation systems", *Journal of Urban Economics,* vol. 33, pp. 361-376.

Windmeijer, F. 2005, "A finite sample correction for the variance of linear efficient two-step GMM estimators", *Journal of Econometrics,* vol. 126, no. 1, pp. 25-51.