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The Effect of Eminent Domain on Private and Mixed Development on Property Values

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Abstract: The objective of this study is to assess the impact of eminent domain (ED) for private and mixed development on property values in Rochester, New York, within 107 months of policy announcements and construction initiations. This study includes data on 19,707 screened house sales. By using both parametric and semiparametric models, this study concludes that the Midtown Plaza (MP) redevelopment project purely for private development generates positive policy externalities on property values across the city. However, homeowners lost property value if they lived within a one mile radius of the MP center after the policy announcement. The average citywide housing prices dropped by 8.2% after the MP demolition began, and yet, homeowners living within a one mile radius of the MP neighborhood enjoyed an 8.7% property value gain after the start of the MP demolition. There is no significant credible policy impact from the Brooks Landing (BL) project. This project for mixed development aims for both public and private revitalization. Citywide housing prices dropped by 6.8% after the start of the BL site demolition and homeowners suffered a 1.4% property value loss for each mile closer to the BL site under demolition. The semiparametric model takes spatial heterogeneities and nonlinearities into consideration; thus, due to the spatial dependence problem within the dataset, it is superior to the parametric model in this study.

1. Introduction

Eminent domain (ED) is popularly deemed either an important tool for elevating the living standards in neighborhoods and rejuvenating cities or a violation of private property rights. Munch (1976, p. 473) describes ED as "the legal right to acquire property by forced rather than by voluntary exchange. When a buyer seeking to acquire a property has the power of ED, he must attempt to negotiate a voluntary sale. But if his highest offer is rejected, he may condemn the property, that is, obtain a forced sale at a price determined in a court of law." Eminent domain is an economic policy with a long history. Initially there was with no compensation, partially because land was abundant, but after the Fifth Amendment to the Constitution, compensation at the market value became mandatory and ED is now allowed only for public use. Public use includes construction of roads, parks, schools, hospitals, etc.

The use of ED is most controversial in the prevalent applications to a large-scale economic redevelopment project: proponents of strong governmental powers deem ED the solution to market failures and help acquire property for purposes of redeveloping blighted inner cities, while others are property rights advocates who see more government failures and deem unconstitutional such actions as transferring property from one private party to another (Benson and Brown, 2007). The question here is: does the use of ED for private development produce positive externalities for the city's property values? It becomes more urgent to answer this question after the *Kelo v. New London* lawsuit, in which the drug company Pfizer built a new plant in 1998 in New London, Connecticut, aiming to bring in more jobs and government revenues. The City of New London decided to purchase 115 additional houses in a nearby area to sell them to commercial developers, but 15 residents, including Kelo, resisted, so the city used ED (545 U.S. 469, 2005). The public outrage from the *Kelo* case led many states to think about the lawful applicability and politically viable use of ED for private development and even mixed development.

The legal justification of ED is based on the Fifth Amendment to the Constitution, which grants the power of ED to government only for 'public use' and with 'just compensation' (U.S. Const. amend. V, sec. 2). The definition of public use has been broadened to include anything that benefits the public, such as inner city revitalization, downtown redevelopment, and airport expansions. The U.S. Supreme Court continued to expand its definition to include aesthetic considerations. Liston (2013) summarizes the *Berman v. Parker* case in 1954 when the court ruled that the government can transfer property from one private party to another as part of a redevelopment plan that serves a public purpose; however, a property owner objected to the government's taking a piece of property that was not blighted. In *Poletown v. City of Detroit* (1981), the Michigan Supreme Court condemned a large tract of land to be conveyed to General Motors Corporation, under the conjecture that a new assembly plant would help revitalize the economy of the state. Growing and extensive uses of ED during the recent economic recession have caused widespread concern, and these debates have been centered on whether there is an abuse of ED for private gains.

The current concern is how the government seizing property and providing it to private developers or individuals affects nearby property values. To answer this question, I collected ED data, house sales data, and GIS data from the City of Rochester, New York, to explore the impact of two most recent projects that used ED on property values. The two study cases in Rochester are the Midtown Plaza (MP) project, which was initially announced in November 2006, and, after many false starts, the Brooks Landing (BL) project for redevelopment, which was announced in November 2005 (the credible announcement). The MP project is purely for private development, while the BL project is a mixed development (public and private). This study questions whether these two different projects create the same social benefit measured by improvements of single-family residence values, which are determined by both the houses' physical and locational characteristics.

In this paper different statistical models, including OLS (Ordinary Least Squares), fixed effects, and semiparametric models, are employed to investigate the impact of eminent domain for both private and mixed development on property values. The general form of fixed effects models is $Y = \alpha_i + X'_{it}\beta + u_{it}.$ Dealing with the spatially referenced data, semiparametric models have been frequently applied because they keep the explanatory power of parametric models and the flexibility of nonparametric models (Li and Mei, 2013). The semiparametric model is partially linear and partially nonlinear, having general form $Y = X\beta + m(z) + \varepsilon$. The function m does not have any predefined functional form, and its error distribution cannot be assumed to be of any specific type. The commonly used parametric hedonic pricing model assumes that there is a linear relationship between the housing prices and locational variables. However, incorrect functional forms and omitted variables that are correlated over space produce spurious spatial autocorrelation (Basile et al., 2014). Thus, a semiparametric model including spatial parameters (latitude and longitude as a vector of z in the function m) is employed in this study to take both spatial heterogeneity and nonlinearities into consideration.

2. Literature review

2.1. Economic analysis of eminent domain

Research on the impact of ED on various economic outcomes generally falls into three different categories. The first category finds evidence that ED promotes economic growth. Collins and Shester (2010) used data on more than 25,000 residents in two years (1950 and 1980) to investigate whether more intensive urban renewal programs led to better economic outcomes in 1980. This study used OLS regression model with city-level control variables and census-division dummy variables to estimate the program's effects on city-level outcomes, which included median family income, median property value, employment, and poverty rates. The pre-program control variables included housing stock, population, and economic characteristics in 1950. The authors found that the urban renewal programs led to higher median incomes and higher median property values in 1980. However, some of the census division dummy variables such as *Mountain, Pacific, South Atlantic*, etc., are very sensitive to model specification due to possible spatial dependence problems. Their OLS model just assumes that those locational dummy variables have a linear relationship with the three city-level outcome variables. These potentially serious misspecifications may yield biased and/or inefficient parameter estimates (Brenner, 1977).

The second group of studies found that ED projects have mixed or no net impacts on economic outcomes. Munch (1976) used data from the Chicago Department of Urban Renewal for three large projects during the period of 1962-1970. He also used an OLS model to estimate the relationship between market value, assessed value, and property characteristics from sample data of homes sold on the open market compared to those sold under urban renewal projects. Munch found that, under ED, high-valued parcels systematically received more than market value and low-valued parcels received less than market-value. This early literature only includes seven explanatory variables, and the zoning dummy variable is also sensitive to possible spatial dependence problems.

Carpenter and Ross (2010) examined whether limiting the use of ED for private-to-private transfer of property significantly harmed economic growth. Their study used hierarchical linear modeling to measure economic effects on three dependent variables: construction jobs, building permits, and property tax revenues. They hypothesized that if efforts to limit ED harm economic development, trends in those three variables should have turned negative after legislation becomes effective. For building permits, covariates included the number of sales of existing houses and aggregate personal income; total tax revenues and home vacancy rates were control variables for property tax; and overall labor force minus construction employment and building permits were control variables for construction jobs. This study analyzed each of the indicators separately by using linear models and state-level quarterly data from all 50 states from 2004 to 2007. Results indicated that there were no negative economic consequences after the legislative/judicial change.

The last group of studies found that ED had a negative impact on economic outcomes. Carpenter and Ross (2009) discovered three waves of gentrification that varied with respect to the two distinct characteristics of state involvement and extent of gentrification. The first wave of gentrification from 1960s to early 1970s includes significant state involvement mainly in the large northeastern cities in the U.S. Meanwhile, the second wave of gentrification which surged from the late 1970s to the early 1990s was characterized by less state involvement but more private market gentrification. The third wave of gentrification occurred after the early 1990s with increasing government involvement in public-private partnerships and many times involved entire neighborhoods. Carpenter and Ross' data included 184 areas targeted by ED for private development. For each project area the percentages of minority residents, children and senior citizens, and renters and owners along with education and poverty levels were analyzed using independent sample t-tests to study differences between project areas and surrounding communities. The study indicated that a greater percentage of minority residents (58%) compared with their surrounding communities (45%) were in the areas targeted by ED for private development. Similar results were found for education and income variables, leading the authors to conclude that ED disproportionately hurt poor, minority, and other historically disenfranchised community members.

Kerekes and Gulf (2011) used Dana Berliner's data of ED use for private benefit for all 50 U.S. states extracted from court papers and published accounts spanning from 1998 to 2002. They used basic Poisson models and found that ED for private benefit is utilized more widely in states with higher rates of corruption, appointed Supreme Court judges, less fiscal decentralization, and lower economic freedom.

2.2. Nonparametric hedonic models

Bin and Filho (2001) investigated 1,000 recorded sales in the Portland-Oregon housing market between 1992 and 1994 to estimate a hedonic price function with application to additive nonparametric regression modeling. They argued that the functional form specification problem common in hedonic price models can be conveniently addressed by modeling the conditional mean of prices in a nonparametric environment. They compared their results to an alternative parametric model and found evidence of the superiority of nonparametric model.

McMillen and Redfern (2010) used all sales of single-family homes in 2000 that are within one mile of Chicago's elevated train line. They used GIS to measure distance from Chicago's city center and showed how nonparametric and semiparametric procedures assist in the specification of a hedonic house price function. They argued that semiparametric estimation procedures can control for spatial variation in marginal effects while also allowing for nonlinearities.

Haupt, Schnurbus, and Tschernig (2010) performed a replication of Parmeter et al. (2007), applying nonparametric methods for estimating hedonic house price functions and comparing the results to the parametric and semiparametric specifications. They extended their analysis by using the nonparametric specification test used in Hsiao and Racine (2007) for mixed continuous categorical data and simulation-based prediction comparisons. They found that the previously proposed parametric specification does not have to be rejected but suggest that the nonparametric methods still provide valuable insights during all modeling steps.

Therefore, while there are many studies on the relationship between ED and various economic outcomes and also many studies preferring nonparametric to parametric specification, none has specifically focused on the relationship between local property values and ED used for both private and mixed development. Compared to the previous similar literature mainly using simple linear models, this study uses both the parametric and semiparametric models to improve the measurements of ED's impact on property values. The parametric fixed effects model taking into account within-neighborhood heterogeneities helps compare with the semiparametric model. The semiparametric analysis in this paper is mainly based on McMillen and Redfern (2010), including geographic coordinates in the nonparametric part to solve the spatial dependence problems.

3. Study area and data

The Midtown Revitalization (MP) project was undertaken by private development company Midtown Tower LLC, which is a partnership of Buckingham properties and Morgan Management. As shown on Figure 1 as a square, MP is located in the center of Rochester. It focuses on the revitalization of the city center. This plan is attempting to transform the former Midtown Plaza into a more attractive neighborhood. The announcement of the MP revitalization project was in November 2006, and demolition started in October 2010. The second project is Brooks Landing (BL), which is located in southwest Rochester, marked by a diamond on Figure 1. The BL project is a public/private development project to improve economic conditions through ED. The project announcement was in October 2005, after many false starts, and the demolition began in September 2006. This project consists of a mixed-use development including boat storage facility, restaurant, student housing, parking spaces, and a credit union drive-through operation (City of Rochester, 2012).

This study creates four dummy variables (*MPP_d, BLP_d, MPD_d* and *BLD_d*) to split the sales before and after the MP and BL projects policy announcements and site demolitions. Two dummy variables (*MPN* and *BLN*) are created to represent the houses located in the MP and BL neighborhoods (areas within a 0.5 mile radius of the centroid of the ED project), and they also interact with the earlier created four dummy variables to create four more variables (*MPP_n, MPD_n, BLP_n* and *BLD_n*). The descriptions and summary statistics of the key variables are listed in Table 1.

There are several sources of data used to estimate the impact of the ED projects for private and mixed development on property values. The primary dataset consists of single-family residential transactions occurring between 2000 and May 2013 in Rochester. This study period covers the recent "Great Recession" from December 2007 to June 2009. Fourteen yearly dummies are created to control for annual economic fluctuations. The housing prices are transformed to adjust for inflation, with the base year 2000. Data on sale prices and property characteristics were compiled from information provided by the Department of Assessment & Taxation. After deleting the multi-family, land, and commercial sales data from the original 28,487 records, there were 19,707 single-family residential house sales left for this study. The single-family house data also includes the number of bathrooms, fireplaces, bedrooms, stories in structure, garage car spaces, per square foot, an exterior construction of concrete or stucco, distance to the nearest school, library, or CBD, etc., since they are very likely to affect housing prices positively (Cebula, 2009).

Addresses of ED areas and GIS shapefiles of schools, libraries, parks, recreation centers and CBD were acquired from the Department of Neighborhood & Business Development. The home addresses are geocoded to obtain the longitude and latitude of each observation in order to calculate the distance to the Midtown Plaza and Brooks Landing areas (*MP_DIST* & *BL_DIST*).[1] Brooks Landing areas include both private development and public project areas. *BL_DIST* only accounts the nearest distance

[1] The school district, library and CBD are also added on the map using the same way to create distance variables by using the 'near' function of the ArcGIS in the 'proximity' category.

from each house to the area for private development. These distance variables have to interact with the four dummy variables (*MPP_d, MPD_d, BLP_d and BLD_d*) to create four more distance variables (*MPPD, MPDD, BLPD* and *BLDD*) to get the exact distance impacts on property values after their policy announcements and the start of their demolitions.

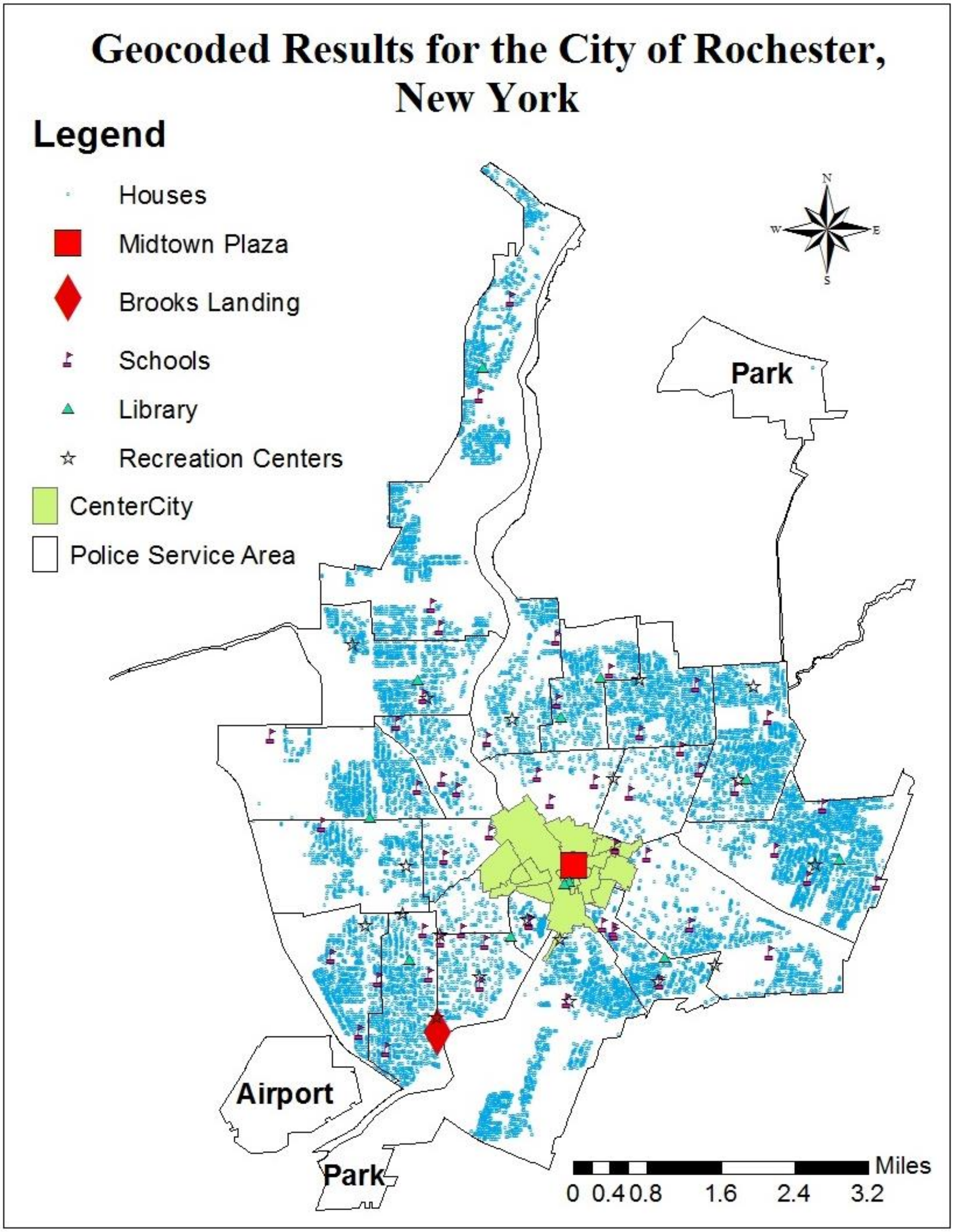

Figure 1. Study area and geocoded results.
Note: More detailed maps of the projects can be found in the appendix.

Table 1. Descriptions and summary statistics of key variables.

Variable	Description	St Dev	Min	Mean	Max
MPP_d	MPP_d =1 if the houses were sold after 11/2006 (when the MP policy was announced)	0.4979	0	0.4541	1
MPD_d	MPD_d =1 if the houses were sold after 10/2010 (when the MP demolition started)	0.3593	0	0.1522	1
MP_DIST	The nearest distance to the MP area in miles	1.0639	0.27	2.5038	7.593
MPPD	MPPD = MP_DIST * MPP_d	1.4152	0	1.1147	7.588
MPDD	MPDD = MP_DIST * MPD_d	0.9537	0	0.3660	7.585
BLP_d	BLP_d =1 if the houses were sold after 11/2005 (when the real BL policy was announced)	0.4981	0	0.5437	1
BLD_d	BLD_d =1 if the houses were sold after 09/2006 (when the BL demolition started)	0.4991	0	0.4702	1
BL_DIST	The nearest distance to the BL area in miles	1.7651	0.037	3.4585	9.362
BLPD	BLPD = BL_DIST * BLP_d	2.1385	0	1.8603	9.360
BLDD	BLDD = BL_DIST * BLD_d	2.0813	0	1.5992	9.360
MPN	MPN = 1 if houses are located within a 0.5 mile radius of the centroid of the MP site (MP neighborhood)	0.0396	0	0.002	1
MPP_n	MPP_n = MPN * MPP_d	0.0310	0	0.0010	1
MPD_n	MPD_n = MPN * MPD_d	0.0175	0	0.0003	1
MP1m	MP1m =1 if houses are located within a one mile radius of the MP neighborhood	0.1703		0.0299	1
MPP1m	MPP1m = MP1m* MPP_d	0.1206	0	0.0148	1
MPD1m	MPD1m= MP1m * MPD_d	0.0725	0	0.0053	1
BLN	BLN =1 if houses are located within a 0.5 mile radius of the centroid of the BL site (BL neighborhood)	0.1595	0	0.026	1
BLP_n	BLP_n = BLN * BLP_d	0.1190	0	0.0144	1
BLD_n	BLD_n = BLN * BLD_d	0.1132	0	0.0130	1
BL1m	BL1m =1 if houses are located within a one mile radius of the BL neighborhood	0.2454	0	0.064	1
BLP1m	BLP1m = BL1m * BLP_d	0.1831	0	0.0347	1
BLD1m	BLD1m = BL1m * BLD_d	0.1711	0	0.03	1
BDS	The number of bedrooms	0.7841	1	3.086	32
BTH	The number of bathrooms	0.5412	1	1.366	9.5
AGE	The age of the house	25.475	0	81.898	211
LAT	The latitude of each house	0.0284	43.11	43.17	43.27
LONG	The longitude of each house	0.035	-77.68	-77.61	-77.54

4. Methodology

A semiparametric model is a combination of parametric and nonparametric approaches. The benchmark OLS model assumes a very strict functional form in which the dependent variable is determined by the regressors and unobserved errors based on a fixed structure. The disadvantage of parametric models, including the fixed effects model, is the requirement that both the structure and the error distribution are specified correctly. Nonparametric models, on the other hand, impose very few restrictions on the functional form, so there is little room for misspecification (Powell, 1994). However, the precision of estimators which impose only nonparametric restrictions is poor (Powell, 1994), and there is always a "curse of dimensionality". A semiparametric model combines the merits of parametric and nonparametric models.

The parametric part of the semiparametric model is:

$$\begin{aligned}\ln P_{it}^{*} &= \alpha * + \theta_1 MPP\_d + \theta_2 MPD\_d + \theta_3 MP\_DIST \\ &+ \theta_4 MPPD + \theta_5 MPDD + \theta_6 MPP\_n + \theta_7 MPP1m \\ &+ \theta_8 MPD\_n + \theta_9 MPD1m + \theta_{10} BLP\_d + \theta_{11} BLD\_d \\ &+ \theta_{12} BL\_DIST + \theta_{13} BLPD + \theta_{14} BLDD + \theta_{15} BLP\_n \\ &+ \theta_{16} BLP1m + \theta_{17} BLD\_n + \theta_{18} BLD1m + \varepsilon_{it}^{*}\end{aligned} \quad (1)$$

The dependent variable price has a natural log form, since the coefficient on the natural-log scale is directly interpretable as approximate proportional differences. The procedure for the smoothing part of the semiparametric model is LOWESS, which is a procedure for fitting a regression surface to data through multivariate smoothing: the dependent variable is smoothed as a function of the independent variables in a moving fashion analogous to how a moving average is computed for a time series (Cleveland and Devlin, 1988). The smoothing degree varies, usually falling between 0 and 1. For example, if the window size is 0.2, it indicates that the smoothing window has a total width of 20% of the horizontal axis variable. Different from parametric smoothing techniques requiring functional forms beforehand, this nonparametric smoothing method allows the data to speak for itself. Thus, the fitted curve drawn by lowess is generated empirically rather than through prior specifications about any structural nature that may exist within the data. A detailed application to housing price functions is found in McMillen and Redfearn (2010). The target for the nonparametric estimator is a house with structural and locational characteristics given by the vector X. The LOWESS estimator is then derived by minimizing the following equation with respect to α and β:

$$\sum_{i=1}^{n} (LnP_i - \alpha - \beta'(X_i - X))^2 K\left(\frac{X_i - X}{h}\right) \quad (2)$$

The kernel function $K(z)$ determines the weight of each house sold as an observation in estimating the house price at target point X, with $X_i - X$ defined as the distance between the target point and the ith neighboring house and h a smoothing parameter called the bandwidth. As the distance increases, the weight declines; thus a kernel represents a decreasing function of a distance between two objects. Though there are various types of kernels, such as uniform, Ephanechnikov, biweight, triweight or Gaussian, the choice of kernel weight function usually has little effect on the results. This study uses a tri-cube kernel, but h is more important since it determines how many observations receive positive weight when constructing the estimate as well as how rapidly the weights decline with distance. By placing more weight on more distant observations, high values of h (i.e., larger bandwidth) imply local regressions that produce more smoothing than do smaller bandwidths (McMillen and Redfearn, 2010). The choice of an optimal bandwidth is a crucial procedure in the nonparametric part of the semiparametric analysis. This study uses Silverman's Rule of Thumb to determine the optimal bandwidth. Silverman proposes the rule-of-thumb bandwidth as

$$h = \hat{\sigma} C_v(k) n^{-1/(2v+1)} \quad (3)$$

where $\hat{\sigma}$ is the sample standard deviation, v is the order of the kernel, and $C_v(k)$ is a constant depending on the type of kernel used. Since this study uses the triweight kernel, according to the Silverman Rule the constant is 3.15 if the kernel order is 2. Since the latitude and longitude of each house are estimated in the nonparametric part, their average standard deviation is 0.063, as given in the Table 1. Plugging this number in the rule-of-thumb function, the optimal bandwidth for this study is about 0.03.

5. Empirical results

The impact of ED on private property values is largely an empirical question, since there are reasons to expect that redevelopment using ED may either increase or decrease property values in the short run. Redevelopment acts as a form of insurance for future neighborhood quality, raising property values with possible positive spillovers to adjacent communities. On the other hand, time-consuming and inefficient redevelopment projects may reduce nearby property values due to construction noise, congested traffic, and lost investor/consumer confidence.

Table 2 records the parametric fixed neighborhood effects and semiparametric regression results for key variables. The regression results for the rest of the variables are in Table A1 in the Appendix. Figure 2 records the graphical comparisons of results under these two specifications: both the fixed neighborhood effects and semiparametric specifications indicate that the citywide housing prices increased, by 9.8% and 10.7%, respectively, after the MP policy announcement. However, they dropped by 6.7% and

8.2%, respectively, after the city started the MP demolition. Both specifications indicate that after the policy announcement the homeowners enjoyed property value gains, of 2.6% and 3.2%, respectively, for each mile closer to the MP area. However, homeowners living in the MP neighborhood suffered about 42.8% and 43.9% loss of their property value, respectively, under the two specifications, after the MP policy announcement.

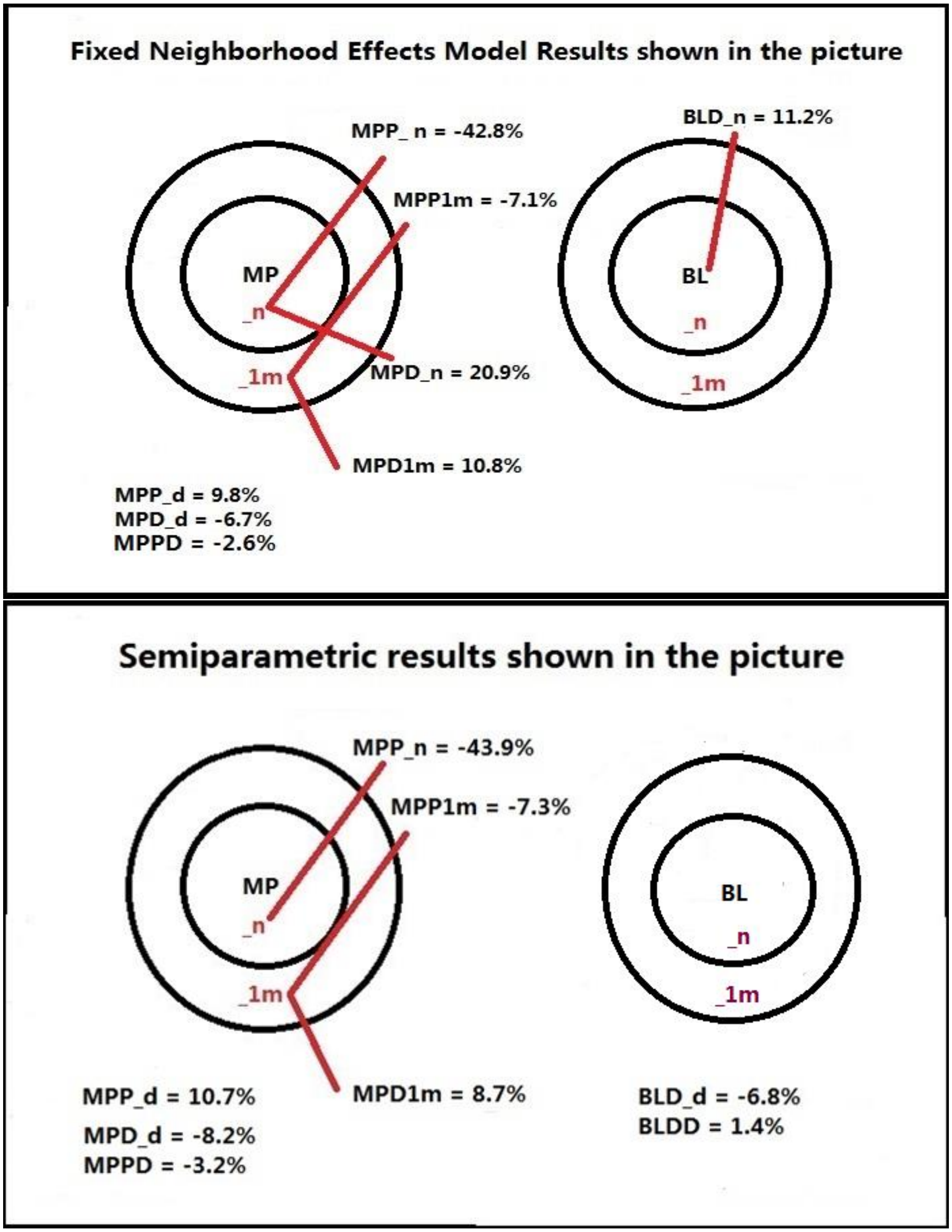

Figure 2. Graphical parametric and semiparametric regression results for both Midtown Plaza (MP) project and Brooks Landing (BL) project.

Table 2. Regression results under fixed effects and semiparametric specifications.

Variables	Fixed Effects Model	Semiparametric Model
INTERCEPT	8.905 (0.239)***	N/A
MPP_d	0.098 (0.037)**	0.107 (0.03)***
MPD_d	-0.067 (0.031)*	-0.082 (0.026)**
MP_DIST	0.047 (0.105)	0.047 (0.114)
MPPD	-0.026 (0.011)*	-0.032 (0.005)***
MPDD	0.01 (0.009)	0.011 (0.006)
BLP_d	0.049 (0.038)	0.047 (0.03)
BLD_d	-0.067 (0.036)	-0.068 (0.026)**
BL_DIST	0.043 (0.042)	-0.001 (0.069)
BLPD	-0.003 (0.005)	-0.003 (0.005)
BLDD	0.014 (0.007)	0.014 (0.005)**
MPN	0.158 (0.087)	0.135 (0.096)
MPP_n	-0.428 (0.064)***	-0.439 (0.103)***
MPD_n	0.209 (0.035)***	0.234 (0.127)
MP1m	0.061 (0.035)	0.047 (0.027)
MPP1m	-0.071 (0.033)*	-0.073 (0.025)**
MPD1m	0.108 (0.043)*	0.087 (0.034)**
BLN	-0.031 (0.032)	-0.073 (0.036)*
BLP_n	-0.035 (0.028)	-0.033 (0.055)
BLD_n	0.112 (0.041)**	0.107 (0.055)
BL1m	-0.026 (0.03)	-0.034 (0.023)
BLP1m	-0.011 (0.031)	-0.011 (0.034)
BLD1m	0.024 (0.04)	0.02 (0.034)
Adjusted R^2	0.904	
AIC	0.068	
House characteristics	x	x
Year control	x	x
Control groups	130	
Spatial control		x
Observations	19,707	19,707

Note: standard errors in the parentheses; * 5% significance; ** 1% significance, *** 0.1% significances.

In addition, the two specification results indicate that the homeowners living within a one mile radius of the MP neighborhood suffered 7.1% and 7.3% losses of their property value, respectively, after the MP policy announcement. In contrast, homeowners living within a one mile radius of the MP neighborhood enjoyed 10.8% and 8.7% property value gain, respectively, under the two specifications, after the MP demolition began. The only difference between these two specification results is the impact on the houses located within the MP neighborhood after the city started MP demolition. The fixed effects model indicates that after the city began tearing down MP, homeowners living within the MP neighborhood enjoyed a 20.9% property value gain. However, the semiparametric model indicates insignificance related to this variable (*MPD_n*).

Both models indicate very few significant impacts on the property value from the mixed BL project. The fixed effects model indicates that homeowners living in the BL neighborhood enjoyed an 11.2% property value gain after the city started the BL demolition.

The semiparametric model indicates that there is no significant impact on homeowners living in the BL neighborhood after the BL demolition began, but the citywide housing prices dropped by 6.8% and homeowners suffered a 1.4% loss of their property value when they moved one mile closer to the BL site after the city started the BL demolition. Both specifications reach the same conclusion for this project: since there had been many false policy announcements, the recent credible policy announcement produced no significant impact on property values. However, when BL demolition started, it started creating real impact. This limited impact is positive under the fixed effects model, but negative under the semiparametric model. The two models generate very similar results for the MP project, which is purely for private development, but contrasting results for the hybrid BP project.

The AIC (Akaike Information Criterion) test result of the fixed effects model (0.068) indicates that the fixed effects model is already a very good specification (0.068 < 0.1); the adjusted R^2 value (0.904) also indicates the same. However, Figure 3 below shows that there are some violations of its parametric assumptions. According to the Anderson-Darling test, the error structure is not normally distributed (p-value < 0.05). The residual vs. fits plot indicates that the equal error variance assumption is also violated. Therefore, this study confirms the appropriateness of using a semiparametric model, which is a much more flexible functional form than any parametric model.

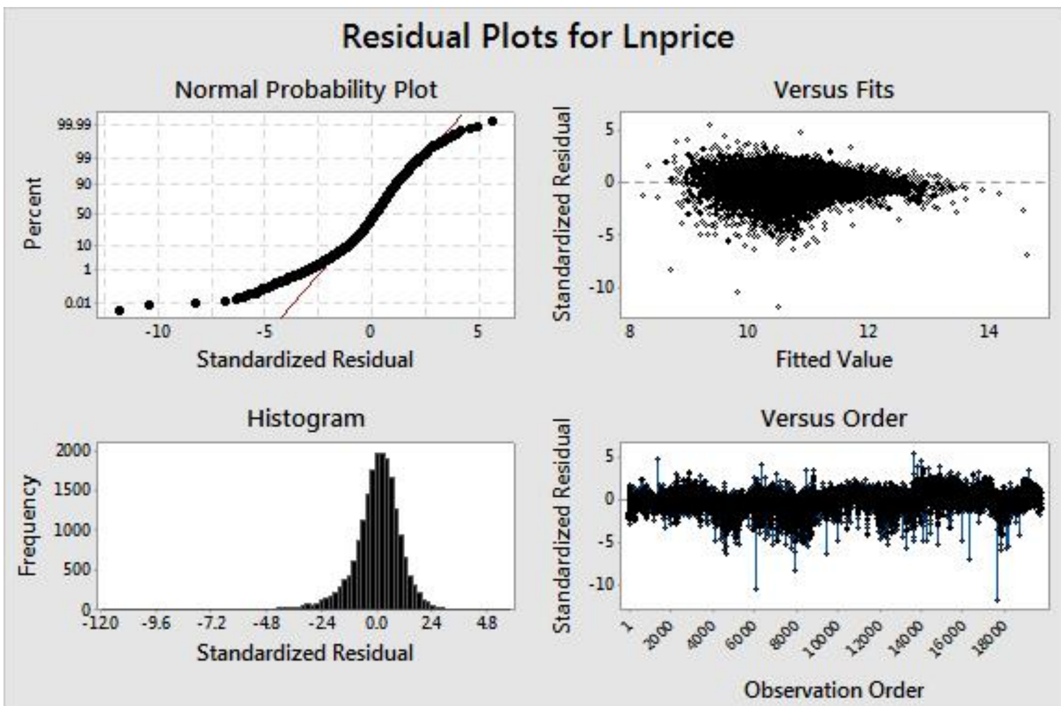

Figure 3. Residual plots for the dependent variable.

Robust research has to deal with the potential misspecification caused by the spatial nature of the data. Spatial heterogeneity is one obvious reason to use nonparametric models for spatially referenced data. When all of the variables are included in the regression model, it loses degrees of freedom, which leads to the 'curse of dimensionality'. The semiparametric model is better since it captures the spatial heterogeneities. Testing Moran's I measure of spatial autocorrelation results in rejecting at $\alpha = 0.05$ the null hypothesis that there is zero spatial autocorrelation present in the variable *Lnprice* . Figure 4 indicates that there are evident spatial heterogeneities across the plane of the study area.

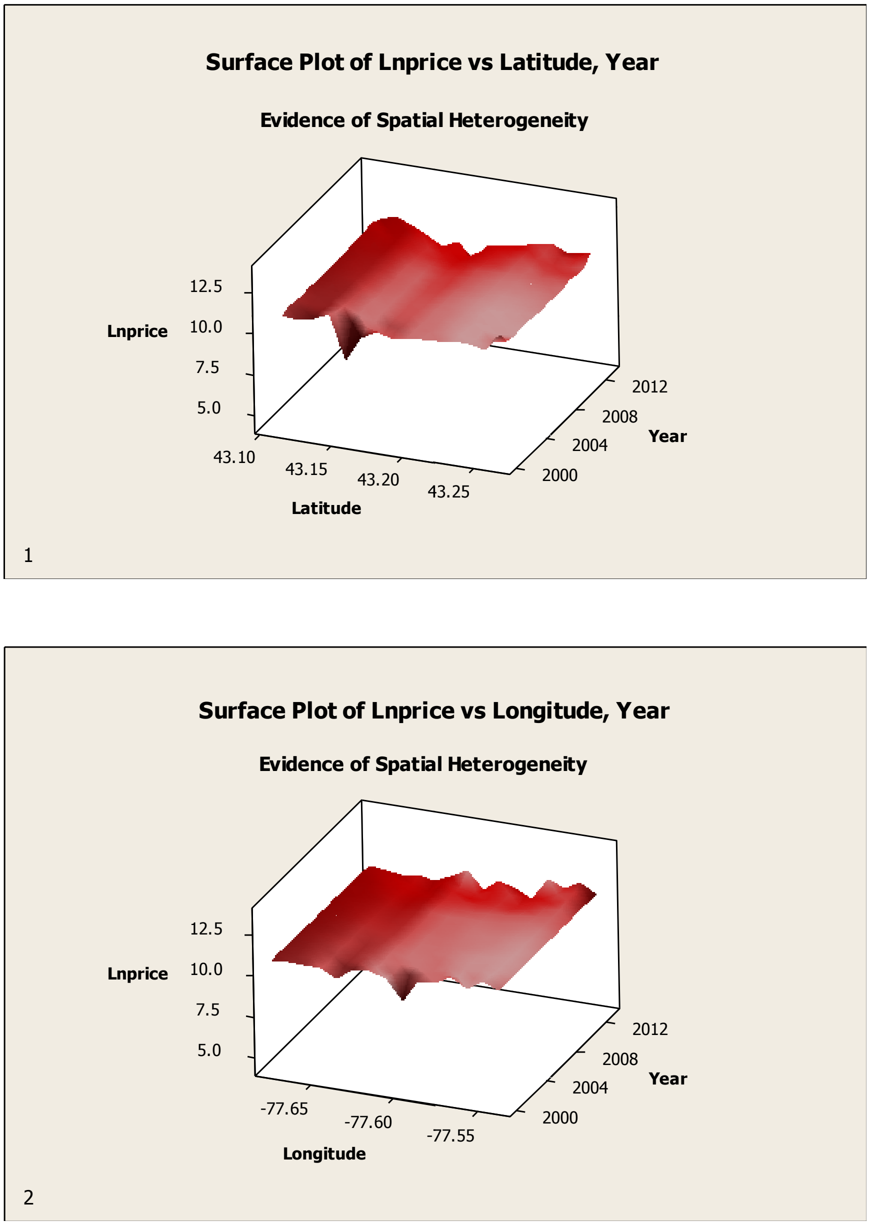

Figure 4. Surface plots of Lnprice vs latitude and longitude across the years.

6. Conclusions and discussion

How housing prices vary with adjacent development carries important policy and market implications. The impact of ED for private and mixed development on neighboring communities is a hotly debated topic. Local governments are often interested in the process of gentrification - trying to bring new businesses and residents into moribund city centers. The positive aspects of proximity are related to the revitalized economy in the city center with more amenities added. The downsides of proximity are adverse effects primarily associated with inefficient planning, unfulfilled promises, construction noise, blocked views, and congested traffic.

The purpose of this paper is to evaluate the impact of ED for private and mixed development on property values in Rochester, New York. Based on a large and detailed sample of single-family home transactions, two ED cases, the Midtown Plaza (MP) and Brooks Landing (BL) projects, are studied. The former project is purely for private revitalization, but the latter one is for both private and public redevelopment. For a rigorous analysis, this study uses both parametric fixed effects and semiparametric regressions.

For the MP project, there are many similar results between the two models. Both specifications indicate that the credible MP policy had a positive distance spillover impact. They also indicate that the housing prices dropped by approximately 44% for houses located in the MP neighborhood along with approximately another 7% property value drop for houses located within a one mile radius of the MP neighborhood after the MP policy announcement. Both show that citywide housing prices increased by approximately 10% after the MP policy announcement, but they dropped by 6.7% and 8.2%, respectively, after the MP demolition started. The parametric and semiparametric results also show that there were 8.7% and 10.8% property value drops, respectively, for homeowners living within a one mile radius of the MP neighborhood after the MP demolition began. Both the parametric and semiparametric models indicate that the BL project policy has no significant impact on property values.

There are different economic incentives for different economic participants within the city. Some local residents claim that their city used ED to force closure of the Midtown Plaza malls and then hand the land over to a corporate darling and other well-connected friends, while others are expecting downtown gentrification, which helps attract high-income residents or investors back to their neighborhood. Home buyers might not consider residential houses a good investment in the MP area after the policy announcement due to many uncertainties; thus, there might be less demand for houses located in the neighborhood, which would likely to be condemned soon. On the supply side, some existing homeowners in the MP area may fear that the future physical takings might harm their property value. They might be eager to sell their houses after the initial policy announcement. This rational combination of leftward shift of the demand curve and rightward shift of the supply curve could cause a huge price drop, which is validated by the result of an approximately 44% property value drop in the MP neighborhood and another 7.3% property value drop within a one mile radius of the MP neighborhood after its policy announcement.

On the other hand, people seem to hold positive expectations on the revitalization of their city center. Citywide housing prices increased by 10.7%, and homeowners enjoyed a 3.2% property value gain for each mile closer to the Midtown Plaza after the MP policy announcement. Even though this positive citywide policy shock was at the cost of a small group of people, the previously significant negative impact on homeowners living in the MP neighborhood (*MPP_n*) dropped to insignificance (*MPD_n*) after the start of the MP demolition. Compared to the 7% property value loss for homeowners living within a one mile radius of the MP neighborhood after its policy announcement, they enjoyed an 8.7% property value gain after the start of MP demolition; thus, there is a net 1.4% property value gain for homeowners living in the proximity to the MP neighborhood. Even though there was an 8.2% citywide housing price drop after the MP demolition, there was a 10.7% citywide housing price rise after the MP policy announcement, so there was a 2.5% net property value gain for the whole city.

For the BL project, since it had many false starts, the policy announcement did not produce any credible policy shock. This is validated by the results, which indicate that there is no significance related to the impact of the BL project policy on property values. There are negative impacts resulting from the BL site demolition: citywide housing prices dropped by 6.8% after the city started the BL demolition, and homeowners lost 1.4% for each mile closer to the BL site under demolition. In sum, there are no positive externalities for residential property values regarding this BL project, which was used for both private and public redevelopment. This is an example of inefficient planning.

In summary, eminent domain for private and mixed development is not a certain tool to revitalize the housing market in the city. It involves tradeoffs, efficient planning, and externalities. The seemingly small positive net property value gains from the MP project are not likely enough to justify the huge state funds plugged in the downtown revitalization. However, these results are only for short-term effects; if in the long term the fully revitalized downtown brings prosperity back and increases property tax receipts for the city, using ED for redevelopment with a credible policy announcement might be worthwhile (efficient planning). Future research could also add data after these projects are complete.

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References

Basile, R., M. Durban, M. Minguez, J. Montero, and J. Mur. 2014. Modeling regional economic dynamics: spatial dependence, spatial heterogeneity and nonlinearities. *Journal of Economic Dynamics and Control* 48: 229-245.

Brenner, M. 1977. The effect of model misspecification on tests of the efficient market hypothesis. *Journal of Finance* 32(1): 57-66.

Benson, B., and M. Brown. 2010. Eminent domain for private use: is it justified by market failure or an example of government failure. In *Property Rights: Eminent Domain and Regulatory Takings Re-examined* (pp. 149-170). Palgrave Macmillan.

Bin, O., and M. Filho. 2001. Estimation of hedonic price functions via additive nonparametric regression. *Journal of Economics Literature* 20(1): 93-114.

Carpenter, D.M., and Ross, J. K. 2009. Testing O'Connor and Thomas: does the use of eminent domain target poor and minority communities? *Urban Studies* 46(11): 2447-2461.

Carpenter, D.M., and J. K. Ross. 2010. Do restrictions on eminent domain harm economic development. *Economic Development Quarterly* 24(4): 337-351.

Cebula, J.R. 2009. The hedonic pricing model applied to the housing market of the city of Savannah and its Savannah Historic Landmark District. *The Review of Regional Studies* 39(1): 9-22.

City of Rochester. (2012). Preliminary Findings. Bureau of Planning and Zoning. Retrieved from file:///C:/Users/pyu/Dropbox/2014/Musci/SP-014-11-12_preliminary_findings.PDF.

Cleveland, S.W., and J.S. Devlin. 1988. Locally weighted regression: an approach to regression analysis by local fitting. *Journal of the American Statistical Association* 83(403): 596-610.

Collins, W., and K. Shester. 2010. The Economics Effects of Slum Clearance and Urban Renewal in the United States. Working Paper No.10-W13, Department of Economics, Vanderbilt University.

Haupt, H., J. Schnurbus, and R. Tscherning. 2010. On nonparametric estimation of a hedonic price function. *Journal of Applied Econometrics* 25(5): 894-901.

Kerekes, B.C., and F. Gulf. 2011. Government takings: determinants of eminent domain. *American Law and Economics Review* 13(1): 201-219.

Liston, D. 2013. Summary of Berman V. Parker. *OLR Research Report.* Retrieved from www.cga.ct.gov/2013/rpt/2013-R-0211.htm.

Li, T., and C. Mei. 2013. Estimation and inference for varying coefficient partially nonlinear models. *Journal of Statistical Planning and Inference* 143: 2023-2037.

Lancaster, J.K. 1966. A new approach to consumer theory. *The Economics of Leisure* 74(2): 394-419.

McMillen, P.D., and L.C. Redfearn. 2010. Estimation and hypothesis testing for nonparametric hedonic house price functions. *Journal of Regional Science* 50(3): 712-733.

Munch, P. 1976. An economic analysis of eminent domain. *Journal of Political Economy* 84(3): 473-498.

Parmeter, C., D. Henderson, and S. Kumbhakar. 2007. Nonparametric estimation of a hedonic price function. *Journal of Applied Econometrics* 22(3): 695-699.

Powell, J. 1994. Estimation of semiparametric models. In R.F. Engle and D. McFadden (eds.) *Handbook of Econometrics, Volume IV*. Amsterdam: North Holland. Chapter 41, pp. 2443-2521.

Rosen, S. 1974. Hedonic prices and implicit markets: product differentiation in pure competition. *The Journal of Political Economy* 82(1): 34-55.

Appendix.

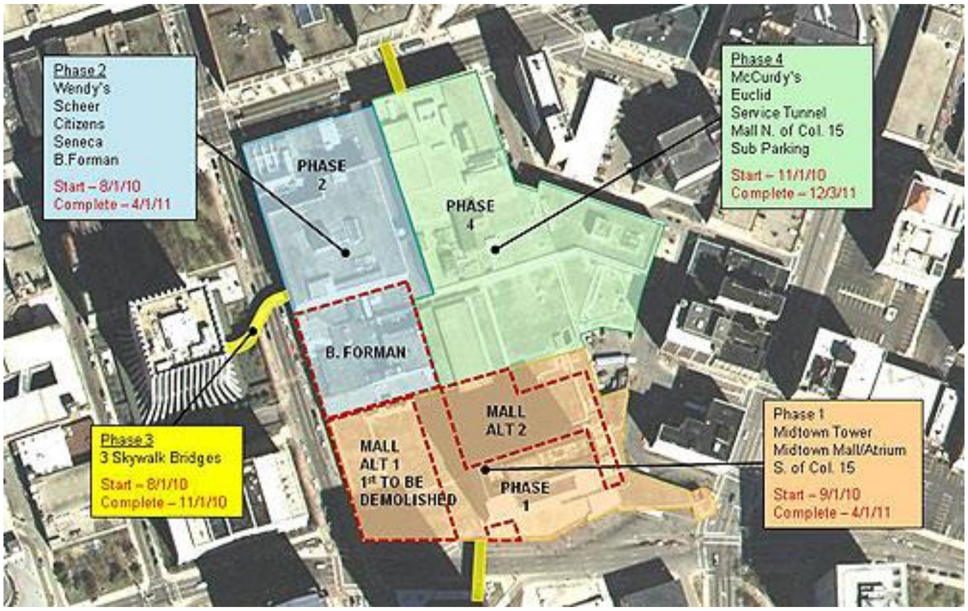

Figure A1. Midtown Plaza (MP) Revitalization Project Map (source: www.cityofrochester.org).

Figure A2. Brooks Landing (BL) Revitalization Project Map (source: http://rocwiki.org/Brooks_Landing_Project).

Table A1. Full results for semiparametric model with 3% bandwidth.

Variables	Estimates	Variables	Estimates
Physical characteristics			
Per Square Footage	0.018 (0.0001)***	# of Rooms	0.01 (0.003)***
Additional Living Area	0.00007 (0.0002)***	# of Bedrooms	0.005 (0.005)
Fished Basement	0.0001 (0.00004)**	# of Bathrooms	0.003 (0.005)
Finished Recreation Room	0.00002 (0.00001)	Air Conditioner	0.02 (0.005)***
Basement Garage	0.006 (0.0122)	Age	-0.001 (0.0001)***
# of Stories	0.073 (0.006)***	# of Fireplaces	0.005 (0.005)
House styles			
Ranch	0.056 (0.035)	Row	0.045 (0.034)
Split Level	0.105 (0.038)**	Log Cabin	0.082 (0.074)
Cape Cod	0.077 (0.034)*	Contemporary	0.087 (0.056)
Colonial	0.052 (0.034)	Duplex	-0.073 (0.052)
Old Style	-0.083 (0.07)	Mansion	0.025 (0.036)
Cottage	-0.4 (0.073)***	Township	-0.103 (0.037)**
House grades			
Poor Grade	-0.647 (0.057)***	Average Grade	-0.089 (0.023)***
Poor Kitchen	-0.046 (0.009)***	Average Kitchen	-0.01 (0.006)
Average Bath	0.049 (0.008)***	Good Bath	0.062 (0.01)***
Poor Interior	-0.413 (0.063)***	Fair Interior	-0.007 (0.057)
Normal Interior	0.108 (0.057)	Good Interior	0.114 (0.056)*
Poor Exterior	-0.619 (0.087)***	Fair Exterior	-0.251 (0.058)***
Normal Exterior	-0.102 (0.058)	Good Exterior	0.096 (0.057)
House materials			
Alum/Vinyl	0.018 (0.0001)***	composition	0.01 (0.003)***
Concrete	0.00007 (0.0002)***	Stucco	0.005 (0.005)
House location			
School Distance	0.056 (0.035)	CBD Distance	0.045 (0.034)
Library Distance	0.105 (0.038)**	Recreation Distance	0.082 (0.074)
Annual trends			
Year 2000	0.331 (0.043)***	Year 2001	0.281 (0.042)***
Year 2002	0.252 (0.042)***	Year 2003	0.234 (0.042)***
Year 2004	0.200 (0.042)***	Year 2005	0.178 (01041)***
Year 2006	0.133 (0.034)***	Year 2007	0.085 (0.026)***
Year 2008	0.078 (0.026)**	Year 2009	0.015 (0.026)
Year 2010	0.043 (0.024)	Year 2011	0.035 (0.015)
Year 2012	-0.012 (0.015)	Year 2013	Omits

Note: standard errors in the parentheses; * 5% significance, ** 1% significance, ***0.1% significance. N =19,707.