

**Bringing the Campus to the Community:
An Examination of the Clark University Park Partnership
after Ten Years**

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Abstract

This case study examines a campus-community partnership conducted by Clark University, the University Park Partnership. Since 1995, this partnership has focused on improving educational opportunities and other neighborhood amenities for residents of the target zone. The study compares developments in the market for housing inside and outside of the target zone after establishment of the partnership. Although the turnover of properties changed little, owner-occupancy within the target zone increased substantially. Evidence from repeat-sales indices and hedonic analysis of the sales prices of homes points to a significant capitalization of benefits within the target zone.

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Bringing the Campus to the Community: An Examination of the Clark University Park Partnership after Ten Years

Introduction

For much of the history of higher education in the United States, institutions of higher learning were restricted to tracts of land set aside for self-contained campuses. Their interactions with the surrounding communities were typically limited to town and gown conflicts over the spillover effects of students. For the one-half of colleges and universities located in center cities, the relationship between campus and community began to undergo a profound change starting in the 1960s. Two developments drove this change. First, incorporating the baby boom generation and the rising numbers of young adults attending college prompted a phase of rapid growth that continues to this day. In addition, this phase of expansion coincided with a steep decline in manufacturing employment in many older urban areas of the Midwest and Northeast. The decline is not yet well understood. For most of the period into the 1990s, the main influence was the relocation of firms to suburban areas and to other parts of the United States (particularly the Sunbelt) (Glaeser, 2005). The decline in employment also coincided with rapid suburbanization that affected all metropolitan areas. Both developments left central cities poorer with decaying neighborhoods and empty factories. They also altered the balance between educational institutions and their communities.

Initially, the main impact of these developments was physical expansion (Perry and Wievel, 2005). Starting in the 1960s, educational institutions approached expansion in the same way that transportation officials of the period approached building freeways. The *spatial* logic of the optimal configuration of the campus, not the needs of the surrounding (low-income) community, governed plans of institutions for land acquisition and new construction. In a remarkable parallel with other large-scale urban projects, a phase of conflicts and then pitched battles ensued. By the 1990s, both sides were developing strategies for resolving these conflicts and accommodating community needs; the principle of the physical isolation of the campus had been broken.

The growth of educational institutions and the restructuring of the economies of inner cities have also prompted a rethinking of the social and economic interaction of the campus and the community. Both narrow self-interest and a broader perspective have prompted this re-evaluation. Many neighborhoods surrounding urban educational institutions began to experience transition starting in the 1960s, which led to rising crime rates and physical deterioration during the 1970s and 1980s. These conditions posed obvious challenges for attracting students, and educational institutions began to pay much closer attention to the surrounding neighborhood. By the 1990s, administrators, community leaders and the local business community also began to recognize the potential positive role that educational institutions could play in the redevelopment of central city neighborhoods and economies. Two-thirds of the financial heft and employment impact of educational institutions is found in inner city areas. The higher

education “cluster” continues to be third fastest-growing export industry of America’s inner cities (ICIC, 2002).

With the support of the Department of Housing and Urban Development, other public agencies and private foundations, campus-community partnerships became widespread during the 1990s (Vidal, et al., 2002; HUD, 2005). The Community Outreach Partnership Center Program (COPC) and related initiatives of HUD, for example, have involved over 300 institutions of higher learning over the past ten years in partnerships featuring housing development and rehabilitation, education, job training and capacity building. Although these efforts are widespread, research into their effectiveness has lagged far behind. A series of articles in *Cityscape* in 2000 (Cox, 2000) points toward some important directions for understanding these impacts and a research report (Vidal, et al., 2002) provides a comprehensive description of high-profile interactions, but neither evaluates their effectiveness. Previous reviews of the literature on evaluating partnerships argue that most research is more instructive on the nuts and bolts of developing partnerships rather than providing careful case studies of results that could lend themselves to comparative evaluation (Rubin, 2000; ICIC, 2002). The Lincoln Institute of Land Policy is very involved with these issues through its program on “The City, Land, and The University” with two recent edited volumes of case studies and analysis of university-community collaborations (Perry and Wiewel, 2005; Wiewel and Knapp, 2005).

The University Park Partnership of Clark University in Worcester, Massachusetts

This paper offers a case study of a campus-community partnership conducted by Clark University in Worcester, Massachusetts: the University Park Partnership (UPP). Clark University was founded in 1887 as a graduate research university, and today it is a liberal arts research university, including nine Ph.D. programs, with approximately 2,500 undergraduate and graduate students. The university is located in the inner city Main South neighborhood about one mile southwest of Worcester’s central business district (CBD). Up until World War II, the Main South neighborhood was a middle-class to upper-middle-class neighborhood. Areas closer to nearby factories, which were built around the turn of the century, provided housing for skilled workers employed in the factories located to the southeast and southwest of the residential neighborhoods (see the map of land uses in Figure 1). As the map in Figure 1 also suggests, a large share of the housing units (about three-fifths) are two- and three-family homes; another one-fifth are apartment buildings of four or more units. Only about one-tenth of the housing stock consists of single family units.

The industrial decline of Worcester followed a path similar to many other New England cities. Figure 2 documents the steady erosion of manufacturing employment in the central city and the growth of employment in the remainder of the Worcester SMSA over the period 1954 through 2002. During the 1950s and 1960s, employment in manufacturing in the city began a process of suburbanization that continues to this day. By the 1970s, factory closures became more common. By 1980, most of the neighborhood industrial sites that ringed the southeast and southwest of the neighborhood

had been converted to other uses or abandoned. A familiar process of housing deterioration, tax delinquency and outright abandonment set in. Illegal drug activity and prostitution were extensive in some parts of the neighborhood.

Census data for 1970 and 2000 confirm the extent of the transition. During the period, average family income in the Main South neighborhood around Clark University went from 83 percent to 44 percent of the city average.¹ Relative and absolute poverty increased so that by 2000, one-third of residents were below the poverty line. Home ownership rates went from one-half to one-third of the city average. By 2000, the majority of the population belonged to ethnic minorities. About 55 percent of residents now speak a language other than English.

The strategy that Clark adopted in response to this challenge recognizes the key linkages between neighborhood quality and institutional success. It presents an alternative to two other approaches that have been chosen by other institutions in similar circumstances. Attempts to physically reshape the neighborhood by creating a buffer around the university, by either buying all property in the vicinity of the university, as other larger universities with more resources have been able to do, or building tall fences around the campus, would be impractical and not consistent with the mission of the university. The university also rejected a move from the central city of Worcester, which it concluded would also be inconsistent with its identity of “Challenge Convention, Change Our World” and long-standing mission in the city of educating local residents. The strategy that emerged from this decision emphasized engagement and investment in the Main South community. Its development followed two phases.

The university first embarked on establishing a partnership with local residents, businesses and churches to stimulate and revitalize the area in early 1980s. Along with neighborhood groups, HUD and local foundations, Clark spearheaded the successful application for a \$74,900 SEEDCO grant from the Ford Foundation. This effort helped buttress the recently-formed Main South Community Development Corporation (MSCDC). Clark has a seat on its board of directors. Typical for similar collaborations, the MSCDC and Clark focused first on neighborhood organizing and halting the spread of property abandonment. Over the next decade, the MSCDC acquired over 20 vacant or abandoned properties and renovated them with an investment of about \$9.5 million. More than half of these properties were subsequently sold.

In 1995, Clark University and the Main South CDC created a broad-based strategy for sustainable development of the neighborhood that became known as the University Park Partnership (UPP). The UPP extended the scope of efforts from a primary focus on the physical condition of the neighborhood to a broad-based strategy that emphasizes developing neighborhood amenities and expanding the economic opportunities for neighborhood residents. The target area for this partnership is presented in Figure 3. It includes most of the Main South CDC area of interest, except for the small triangle to the southwest and the area to the northeast. The partnership has received funding from a variety of federal and private sources and was awarded the inaugural Carter Partnership

¹ The two census tracts are 7312.01 and 7313. Clark University occupies a third tract, 7312.02.

Award in 2004, which is the nation's most prestigious recognition for collaborations between universities and their communities.

Starting in the mid-1990s, the MSCDC's program of physical rehabilitation and incentives for increased home ownership by residents became more ambitious. It targeted two particularly deteriorated areas with multi-million dollar projects of extensive renovation and new construction.² Overall, with the conclusion of the most recent initiatives, the partnership will have renovated over 220 housing units and added an additional 80 units to the local housing stock (see Figure 3). Clark University has contributed almost \$10 million directly to this effort and it has helped leverage another \$75 million in federal, state, local and private loans and investment ("Campus and Community Collaboration," 2005). The Main South CDC also offers programs for first-time homebuyers, provides incentives for ensuring that multi-family dwellings remain affordable and offers loans for home improvements and down-payments. Clark also subsidizes down-payments for faculty and staff who choose to purchase homes in the neighborhood. Twenty employees have taken advantage of this program.

The partnership also expanded its scope to provide specific neighborhood amenities: improved public safety and social and recreational programs for families. The UPP has addressed concerns about safety with the establishment of a neighborhood alert center and it promotes efforts to ensure close cooperation among the Worcester and Clark police and neighbors. For example, on weekend nights, a Worcester city police officer walks the neighborhood with a Clark University police officer. Clark's police force currently includes 12 officers with an annual budget of \$1.15 million. Policing efforts should provide some spill-over benefits to the neighborhood surrounding the university.

Clark has also created social and recreational programs, including free summer camp for 125 neighborhood children. The most recent initiative is the construction of new athletic fields for \$2.5 million located next to the Kilby-Gardner-Hammond project area, which lies outside of the UPP target area. These fields will also be accessible to young people using the new \$7.5 million Boys and Girls Club, which is located adjacent to them (see Figure 3).

Finally, since 1995, the UPP has developed programs for improving the economic well-being of its residents. These initiatives focus on assisting the development of small businesses and providing residents with enhanced opportunities for training and education. The business development efforts include the renovation of several blocks of commercial storefronts and access to small business loans. Training programs in computer skills complement assistance to residents with career counseling and job placement.

² These projects are the Beacon-Oread project, which was completed in 2001, and the Kilby-Gardner Hammond (KGH) project, This latter project received support from the U.S. Environmental Protection Agency of \$161,000 in Assessment funds and a \$200,000 Clean-up grant. The U.S. Department of Housing and Urban Development contributed \$1,000,000 in a Brownfield Economic Development grants and \$1,000,000 in a Neighborhood Improvement Program grant, to help in the remediation of abandoned brownfield sites, (www.epa.gov/Region1/brownfields/success/06/gkhrp_worcester_ma_ag_cg_htm). Phases I and II of the KGH project were completed by the end of 1995.

The most innovative feature of the education and training efforts has been the creation of a targeted partnership that offers access to a high quality education for young people resident in the neighborhood. For students in grades 7 through 12, Clark University and the Worcester Public Schools created a partnership, which resulted in the establishment of the University Park Campus School in 1997. The Campus School is a neighborhood school of the Worcester school system that serves about 200 students. As with other public schools, eligibility for enrollment is limited to a defined neighborhood. The UPCS district consists of the UPP area of Figure 3, plus the southwest triangle area of the MSCDC target area. Overall, the district includes a good share the residential areas of the Main South neighborhood. The backgrounds of the students reflect the socio-economic conditions of the neighborhood. Seventy percent are eligible for the free lunch program; sixty percent do not use English as their primary language at home; and one-half of the students entering the 7th grade are reading at a 3rd grade level.

Over the nine years since its creation, the school's strong curriculum and innovative programming have earned it a reputation as one of the finest urban secondary schools in Massachusetts. Performance on standardized tests is very strong, with students scoring in the top 10% of all schools—both urban and suburban—in the state. The drop-out rate for students at comparable Worcester public high schools is about two-thirds. All graduates of the UPCS have gone on to college. Clark allows UPSC student use of Clark's library and gym and Clark faculty and Clark students volunteer time at the UPCS (Asher, 2005).

For high school graduates in the neighborhood, Clark University offers an unusual benefit. It is only one of a few universities in the nation to offer an unlimited number of free tuition scholarships for neighborhood residents. Any of the approximately 10,000 residents (3,500 households) who have lived at least five years in the neighborhood and who can also meet admissions standards are eligible for full-time admission. To date, 27 students from the neighborhood have received these scholarships. As Figure 3, which provides a map of the UPP target zone, a small triangle of the University Park Campus School catchment area does not receive the tuition benefit.

These initiatives have prompted important changes in the participation of Clark and its partners in the Main South initiative in the local property market. Figure 4 shows the expansion of Clark's land acquisition in Main South over the past half-century, as well as the properties that have been purchased and renovated by the MSCDC. Up until the early 1970s, Clark holdings in the area were about 21 acres; only a few additions had been made to the original 1887 campus on Main Street. Since the 1970s, the university's holdings in the immediate area have doubled. The expansion of the 1970s and early 1980s was primarily for expanded facilities and parking. Since the mid-1980s, two-fifths of the current holdings of 45 acres were purchased. Some of these acquisitions have remained in private sector usage, for example as rental housing or commercial storefronts.

Figure 4 also shows the properties (in dark blue) that have been held at one time or another by Clark's partner, the MSCDC. Table 1 places the holdings of both partners in the effort to improve the Main South Neighborhood in the context of all property

holdings in Main South. Clark and its partner hold about one-sixth of the area and almost one-quarter of the valuation of the neighborhood. The only other larger landholder in the neighborhood is the City of Worcester.

Research Questions and Empirical Strategy

Since 1995, the UPP has invested several million dollars in initiatives that, by benefiting the residents of the target area, should also benefit the university. The thrust of the program is to offer concentrated educational and other benefits that are designed to enhance residential stability and to create strong incentives for educational performance. In the terms of urban economics, these efforts are designed to augment a range of *neighborhood* amenities and may be characterized as a neighborhood good: a good generally available to all residents of a few or several city blocks of a city.³

Several approaches have been taken in the literature to assess how successful efforts to provide neighborhood goods have actually been. These may include examining changes in the turnover of property or in the amount of home ownership. While all of these indicators are of interest and will be reviewed here, the economic theory of the determination of land rents (and value) suggests a more comprehensive measure. Provided that some mechanism such as travel costs or limits on eligibility restricts access to the enjoyment of neighborhood goods, competitive land (and housing) markets in urban areas should lead to their capitalization in the value of (residential) property. In market equilibrium, renters (or purchasers) of housing who are similar in wealth and preferences should also receive equal well-being, wherever they locate in the urban area.

In a reasonably transparent and efficient housing market, bidding among potential residents of any urban area for scarce housing creates site-specific premia (or discounts) for features of property that are not elastically supplied. The premia will ensure equalization of well-being for similar residents.⁴ These premia provide lower-bound (or upper-bound) estimates of how much residents of the city value a site-specific feature.⁵ In the case of the University Park Partnership, we would expect that the amenities provided by the partnership's programs only to residents of the area should generate a market premium for housing sold in the area.

³ Fujita (1989, ch. 6) provides both a precise definition and an overview of the capitalization phenomenon.

⁴ This will not necessarily be true if wages also capture some of the localized amenity, but that seems improbable for workers in such a small subarea of the Worcester labor market.

⁵ If the bid of a household with a given level of utility u and consumption of all other goods X for an amenity of level A is $\varphi(u, X, A)$, then the rent $R(A)$ actually paid for the amenity will be equal to or less than φ , which in turn must have been greater than all other bids $\varphi' < \varphi$. Households receiving greater utility from A (given the same level of other consumption, X) will in turn offer a higher bid. In any event, their valuation could be significantly higher than the price actually paid. Note as well that among households of similar income and resources, those with stronger preferences for the education, safety and recreational benefits of the UPP would be likely to outbid the others. This is an implication of the capitalization hypothesis that will be explored in subsequent research.

Our research strategy proceeds in two steps. We first investigate the general movement in property prices in the UPP neighborhood in comparison with changes in property prices in the Worcester and metropolitan Worcester markets. We would expect that if the capitalization hypothesis is true, similar properties in the UPP neighborhood would appreciate (particularly after the mid-1990s). Our investigation of this hypothesis uses repeat sales indices of prices for the period 1988 to 2005. The results of this investigation suggested some support for the hypothesis, but we preferred also applying a more fine-grained approach as a follow-up.

The unique spatial features of the UPP lend themselves to an application of an alternative hedonic approach.⁶ This part of the case study draws upon one unique spatial feature of the UPP: access to some key features of the UPP is spatially restricted. The clear demarcation of a boundary running through otherwise similar sub-districts of the Main South area neighborhood will help to test the hypothesis that the neighborhood amenities provided by the UPP have been capitalized in housing values.

Empirical Models and Specification

Any effort to infer changes in location-specific amenities from data derived from housing markets faces the challenge of controlling for the heterogeneity of housing. If unmeasured characteristics of housing are correlated with the local amenity of interest, estimates of the amenity's impact on housing (and land) values will overstate the true impact of the amenity. One approach to addressing this problem of unmeasured heterogeneity is to use data on repeat sales of housing, if there are significant changes in the amenity over time. Known as the WRS (Weighted Repeat Sales) method, the index is estimated from the following equation:

$$(1) \ln(P_{it}) - \ln(P_{it'}) = \alpha + \sum \gamma_t D_{it} + \varepsilon_{it}$$

where P_{it} is the price of house i at the time of sale, $P_{it'}$ is the price of the same house at the time of the prior sale and D_{it} takes on the value of -1 at the time of the prior sale and 1 at the time of the sale. The error term ε_{it} is assumed to be independently and identically distributed. The vector of coefficients γ_t resulting from estimating this equation is an estimate of the quarterly or annual change in the index of prices in year t relative to the base year (α).⁷ Recent applications of the repeat-sales methodology have included explicit measures for time-variant changes in disamenities, such as pollution or crime (Zabel, 1999; Schwartz, et al., 2003). Provided that there have not been substantial changes in housing characteristics, the repeat-sales methodology should capture changes in influences on housing prices that are not associated with an individual sale.

The drawbacks of the repeat-sales methodology are well-known (Case and Shiller, 1987). One concern is that the error term may not be strictly i.i.d.; changes in housing prices may be positively related to the elapsed time between sales as the quality of the home

⁶ See Cheshire and Sheppard (1995) for an illustration of this approach, which successfully identifies separate influences on land rents using information on housing prices.

⁷ See Calhoun (1989) for a more detailed discussion of this methodology.

drifts from what prevailed at the time of the initial sale. Case and Shiller (1987, p. 15) argue that this implies that the variance of the error term will be greater with more time between sales. They propose a GLS procedure that weights each observation of a pair of sales with an estimated standard error that reflects the length of time between sales. The repeat sales indices estimated here use this procedure.⁸

The empirical results discussed below first estimate a quarterly repeat sales index for two submarkets of the Worcester city housing market, single family homes and two- and three-family homes, to establish a base-level estimate of the movement in housing prices in the Worcester market. We then test the capitalization hypothesis that there will be a significant difference between price movements in the entire Worcester housing market and the UPP neighborhood. This estimated equation is:

$$(2) \ln(P_{it}) - \ln(P_{it-1}) = \gamma_0 + \sum \gamma_t D_{it} + \delta_0 Z_{it} + \sum \delta_t Z_{it} D_{it} + \varepsilon_{it}$$

where Z_{it} takes on the value of one if the property lies within the UPP and zero otherwise. Note that Z_{it} equals zero until 1996, the first full year of the UPP. The test of the hypothesis is a test that the coefficient vector $(\delta_{1989}, \delta_{1990}, \dots, \delta_{2005})$ is non-zero and individual coefficients (δ_t) are positive. Since the number of repeat sales within the UPP does not support the estimation of a quarterly index, this study estimates an annual version of a repeat-sales index.

The alternative hedonic approach has the advantage of using all information on property sales in a market, rather than just repeat sales. In addition, the influence of some particular features of the housing or local amenities (or disamenities) may be of interest. Rosen (1974) provides the theoretical underpinnings of the hedonic model and the theory of implicit markets. In the context of housing and property markets, hedonic theory suggests that the market price of housing (P) is a function of z bundled structural, site-specific and neighborhood characteristics ($P(z)$) and is equal to the bid of the purchasing household. The theory of implicit markets asserts that the household's bid is in turn a function of how much it values the characteristics, each of which is traded in an implicit market. To get the most for his or her money, each buyer will equate the marginal cost of acquiring the characteristic on the market (the slight addition to the purchase price with a small increase in the area of the home, for example) with his or additional willingness to pay for it. In brief, data on prices in markets for housing can be used to reveal information about how much households actually value (at the margin) various features of housing.

⁸ One other criticism of the repeat sales methodology argues that the sample of homes sold two or more times during a period may suffer from sample selection bias. Researchers have argued that indices covering a long enough time series of sales may mitigate this potential problem.

Hedonic statistical models are thus identified on both the buyer and the seller side of the market. Information from sales prices alone is sufficient to estimate a hedonic function of the form

$$(3) P_{it} = h(\alpha, s, \beta, l, \gamma, g, \tau, \varepsilon_{it}),$$

where

- P_{it} = the price of a house i sold in year t
- s = a (k) vector of parcel/structure characteristics
- l = a (l) vector of neighborhood characteristics
- g = a (m) vector of spatial and location variables
- $\alpha, \beta, \gamma, \tau$ = associated parameter vectors
- ε_{it} = a random error term

and k is the number of parcel/structural characteristics, l is the number of neighborhood and locational characteristics and m is the number of land-use characteristics. Because housing is a bundled good, it is unlikely that the functional form of equation (3) would be linear on *a priori* grounds. Aside from that, economic theory does not suggest the correct functional form for the empirical specification. However, previous research has demonstrated that flexible functional forms, such as the Box-Cox transformation, are superior for empirical specifications of hedonic pricing models. Use of the Box-Cox specification using maximum likelihood estimation allows for the data to choose the appropriate shape of the hedonic price function (Cropper, Deck and McConnell, 1988).

Using the Box-Cox approach, an estimated equation for housing in a neighborhood with amenities and other site-specific attributes would thus be

$$(4) \frac{P_{it}^\lambda - 1}{\lambda} = \alpha + \sum_{k=1}^k \beta_k \frac{s_k^\lambda - 1}{\lambda} + \sum_{l=1}^l \gamma_l \frac{l_l^\lambda - 1}{\lambda} + \sum_{m=1}^m \tau_m \frac{g_m^\lambda - 1}{\lambda} + \varepsilon_{it}$$

The parameter λ can take on a range of values. If λ is equal to one, the relationship between the market price of a property and its characteristics is linear. If λ is equal to zero, the specification becomes a log-log specification. Because they could be undefined if transformed by λ , dichotomous variables are not transformed.

Of most value for this study, the estimates of $\frac{\partial \hat{P}_j}{\partial s_j}$ found from statistical analysis

of equation (4) provide information on how households in the Worcester housing market value the structural features of property. Similar estimates of the marginal valuation of site-specific and neighborhood-specific characteristics can also be calculated from the results of the Box-Cox estimation. Aside from measurable housing characteristics, this study will focus on measured differences in neighborhood disamenities and characteristics of sites, including crime and proximity to brownfields. The impact of local land use amenities and disamenities has been extensively studied by economists. For example, a recent review of the literature on the value of local open space, such as parks, on residential land values (McConnell and Walls, 2005) covered more than 60 articles, with most empirical results suggesting that these local amenities are capitalized

in to nearby property values. A similar review focusing on the impact of negative environmental externalities, such as brownfields, on housing prices (Boyle and Kiel, 2001) also found evidence of (negative) capitalization.

This study of the capitalization hypothesis for the UPP neighborhood exploits one feature of the program noted above: the strict geographic limit placed on key educational benefits (participation in the University Park School and free tuition to Clark University). The “boundary effect” has been used previously in investigations of the impact of school quality on housing values (Black, 1999; Gibbons and Machin, 2003) to estimate unobservable features of neighborhoods common to two districts that may be correlated with school performance on test scores in each district. This approach pairs all houses on either side of a boundary to estimate such a nuisance parameter.

This study exploits the boundary effect in another way. Only properties in close proximity to the UPP boundary on either side were included in the estimation, as these properties most likely share local neighborhood characteristics. Measures for supra-neighborhood characteristics (crime rates and proximity to brownfields) were also included in the estimation to capture larger differences within the UPP catchment area and the surrounding neighborhoods. Finally, the UPP capitalization hypothesis has a time dimension: creation of the UPP offers a treatment effect for houses on the UPP side of the boundary that should vary with time (before and after the creation of the UPP in 1995). The final specification of the hedonic regression thus included time-varying estimates of the capitalization of the amenities offered by the UPP:

$$(5) \quad \frac{P_{it}^\lambda - 1}{\lambda} = \alpha + \delta_o Z_{it} + \sum_{k=1}^k \beta_k \frac{s_k^\lambda - 1}{\lambda} + \sum_{l=1}^l \gamma_l \frac{l_l^\lambda - 1}{\lambda} + \sum_{m=1}^l \tau_m \frac{g_m^\lambda - 1}{\lambda} + \sum_{t=1996}^{2005} \delta_t Z_{it} + \varepsilon_{it}$$

where Z_{it} takes on a value of one if the property is located within the UPP and zero otherwise. The specification offers a direct test of the capitalization hypothesis: the test of whether the δ_t are individually or jointly equal to zero. Note that this specification allows for maximum flexibility for specifying the relationship between property values inside the UPP and outside of it. A finding that δ_o equals zero would imply the UPP neighborhood was identical to surrounding neighborhoods except for the measureable differences in structures and neighborhood disamenities and capitalization was not taking place. The sum $\delta_o + \delta_t$ provides an estimate of the total impact of being within the UPP during year t . The capitalization hypothesis implies that this sum should be increasing over time or be positive after the creation of the UPP.

Data Description

The parcel-level GIS data for this project were made available to us from a research project based at Worcester Polytechnic Institute that linked City of Worcester parcel-level tax assessment data with other spatial data on roads, parks and brownfields, along

with Block Group level U.S. Census data.⁹ Using information from Clark University, additional information was added to this database on the location of parcels that were eligible for the UPP or UPCS benefits, the location and date of acquisition of Clark properties, and the location and time of sale of MSCDC-renovated properties.

Housing sales data from the Warren Group were purchased for all sales that occurred in the city of Worcester over the period 1988 through 2005. These data include information on the location of the property, date of sale, structure type (e.g. single family, two family; three family; condo), lot size and housing characteristics (e.g. porch, attic). All of these data were merged with the GIS parcel data to create the foundational database used for the analysis. The outcome of merging these data can be seen in Figure 5, which identifies all sales of property over the period 1988 through 2005. Properties that sold more than once are in various shades of red. Figure 6 also shows the boundary of the UPP in light blue.

Linking these sales data and attributes with their geographic location within a GIS allowed us to create a unique assortment of measures of very local spatially-explicit amenities and disamenities for use in the hedonic model. For example, in order to control for small-scale neighborhood characteristics, the GIS was used to create a variable that indicates whether or not a property that sold during the period lies within 100 meters of a brownfield.¹⁰ The expectation *a priori* would be that all else being equal, proximity to a brownfield site would lower the sales price of a property. Figure 6 shows the location of brownfields in the Main South area and identifies the parcels that are within 50 or 100 meters of each brownfield.

A similar variable was created to indicate if a sales property was within 50 meters of a property purchased and renovated by the MSCDC.¹¹ Most properties purchased by the MSCDC are vacant or abandoned buildings, which prior to their renovation are likely to be local disamenities. After renovation, they should be neutral or even offer positive amenities. The photographs in Figure 7 of a three-family home that had once been abandoned illustrate the extent of renovation typical for MSCDC projects. We expect that proximity to a property that had been renovated by the MSCDC would be capitalized in a higher sales price, all else being equal.¹²

The data on assault rates per 1,000 residents are based upon the reports of the 54 Police Statistical Areas for Worcester for all violent crimes (murder, assault and sexual assault)

⁹ Data collected in the Fall of 2003 as part of a project funded by the Commonwealth of Massachusetts and the City of Worcester, Rob Krueger (PI) and Fabio Carerra (co-PI).

¹⁰ Here, brownfields were defined as an oil or hazardous material site as determined by the Massachusetts Department of Environmental Protection.

¹¹ Steven Teasdale and Edita Mirkovic of the Main South Community Development Corporation generously assisted us with the creation of this variable.

¹²As noted above, the renovation program of the MSCDC has been ongoing for two decades, which meant that the variable for proximity to a renovated property varied by time as well as location. As an initial approximation, the variable took on a value of one in the year when the MSCDC acquired the property and thereafter. Adjacent property owners would recognize that MSCDC ownership implied targeted efforts to renovate and restore the property.

committed in 2002, which were then assigned to individual census block groups. Rates were calculated on the basis of the population estimates from the 2000 Census of Population. The area included in the statistical analysis overlapped eight different Police Statistical Areas.

We also include information on the structural characteristic of the sales property from the Warren Group data, including information on whether or not the property was a single-, two- or three-family house; existence of an attic, a porch, or outbuildings; the number of bedrooms and bathrooms; the age of the structure; the lot size and the floor space. The lot size and floor space are measured in square feet. Summary statistics on all variables used in model can be found in Table 2.

Results and Discussion

The discussion of the empirical investigation of the impact of the UPP initiative on the neighborhood surrounding Clark University will first examine evidence on changes in home ownership and property turnover. It will then focus on more precise statistical tests for evidence of capitalization. Both paths of analysis reveal that the UPP had discernible impacts on the property market after its creation in 1995.

With the announcement of the UPP and the benefits associated with it, the property market in the affected area revealed some striking changes. The most dramatic was an increase in number of owner-occupied properties. Figure 8 documents the changes that took place in owner-occupancy in 1996 and in subsequent years. It compares the percent of sales of one- to three-family housing to owner-occupants in the neighborhood surrounding the UPP with the percent inside the UPP. The comparison neighborhood includes all parcels within 3 kilometers (a little under two miles) of the UPP boundary. Because of data limitations, only sales of properties to the owners of those properties in 2001 and 2005 are included.¹³ Despite potential biases in this method, it is apparent that 1996—the first full year of the partnership—marks a break in market behavior. The break affected ownership of single-family houses as well as duplexes and triple deickers. As a share of all sales, the sales to owner-occupants in the UPP rapidly approached the experience of the surrounding neighborhood.

The examination of turnover in the property market provides a more ambiguous result. One extreme of turnover is what is known as flipping property, which is the sale of property within a short period after purchase (see Fannie Mae (2004)). Property flipping is typically viewed as a sign of instability in a housing market or submarket. Figure 9 illustrates the trend in property flipping for the UPP and the comparison neighborhood. It

¹³ The assessment records of the City of Worcester for 2002 and 2006 provide the data on owner-occupancy. Assessment data in machine-readable form that also includes the mailing address of the owner, which is necessary to establish owner-occupancy, is available starting for sales completed in 2001. Sales taking place prior to 2001 appearing in Figure 8 are thus for the subsample of all property sales that were still in the owner's hands in 2001 (and 2005). To the extent that the length of time a property is held is positively related to owner-occupancy, the figure will overstate the degree of owner-occupancy in years other than 2001 and 2005. It seems unlikely that this bias could account for the striking difference between the periods before and after 1996.

uses the definition of flipping found in HUD (2003): a sale of a property within 180 days of purchase. The smaller number of property sales within the UPP result in some noise in the results, but the trend is clear. Both the UPP and the comparison neighborhood experienced stabilization of property sales after 1994, which marked the nadir in property values after the run-up in real estate prices during the later 1980s.

The evidence on trends in owner-occupancy and flipping point to a convergence of the UPP with the surrounding neighborhoods of Worcester. The obvious amount of noise in both indicators for a comparatively small neighborhood such as the UPP preclude concluding a positive association between the UPP initiative and stabilization of the housing market. The capitalization hypothesis permits a clearer statistical test of the impact of the UPP program.

The examination of the capitalization hypothesis proceeded in two steps. The first step was to develop a general background to the movement of property values in the Worcester market and then to test for differences in the movement of property prices between the UPP neighborhood and Worcester as a whole (equation (4)). Overall, the sales dataset for the period 1988 to 2005 has about 32,000 sales of about 18,000 single family, two-family and three-family houses.¹⁴ Repeat sales price indices for single family homes are available from the Office of Federal Housing Enterprise Oversight. These indices extend back to 1980. The index for the Worcester standard metropolitan area (Worcester County) is available on a quarterly basis for single family home sales only. Presented in Figure 10, the index shows a pattern familiar to all those who have studied New England property markets. The steep appreciation during the late 1980s (the period of the “Massachusetts Miracle”) ended in about 1989. Prices fell about 20 percent and required almost a decade to recover to levels prevailing in 1989. Appreciation since that time has been quite steep, in line with the experience along much of the East Coast.

Using a similar methodology, the Warren sales dataset permits calculation of repeat sales price indices for the city of Worcester. The estimated indices cover single family homes and the two- and three-family homes that make up most of the housing stock in central city neighborhoods.¹⁵ These indices are also presented in Figure 10. The average of both the SMSA and the city indices was set to 100 for the period 1988-1990. Because the Warren data are available only from 1988 onwards (at the peak of the boom), the initial true level of the index for the city may be a bit higher or lower than what is presented.

The comparative results are striking. Single family house prices in the city follow the downward trend evident for the entire metropolitan area, but the recovery begins much later. Prices for single family housing were about fifty percent above the peak of the late 1980s at the end of 2005. The prices for two- and three-family housing are more volatile.

¹⁴ Of the remaining 12,000 sales of properties in the dataset, about 6,000 are of condominiums. Because of their unusual status, it has been difficult up to this point to adequately match the condominium sales to the geo-referenced dataset. This will be pursued in further research. In addition, there were about 1,600 sales of buildings with four or more apartments. The remaining sales were mostly of buildings for commercial and industrial uses.

¹⁵ Over one-half of the 13,000 single-family homes and one-half of the 5,000 two- and three-family homes in the dataset had one or more repeat sales.

Worcester's central city neighborhoods were hit with a dramatic decline in prices on the order of forty or fifty percent by the mid-1990s. Recovery was much slower until about 2003, when there was a year of rapid appreciation. This part of the housing stock has appreciated about 75 percent since the late 1980s.

Given the background of these developments in the overall housing market, the capitalization hypothesis implies that price movements in the UPP neighborhood should have been positive after the mid-1990s, and perhaps have been even more rapid. Estimation of separate indices of repeat sales for single family and two- and three-family houses permits a test of whether prices within the UPP behaved differently from the rest of the city. The much larger number of sales of two- and three-family houses in the UPP would lead to more precise estimates for multiple-family dwellings. The detailed results of estimating these two annual indices using the WRS procedure are presented in Appendix Table 1. Following the procedure outlined above in equation (3), the indices for the UPP are estimated using interactive terms for each year. These are found in the right-hand portion of the appendix table for comparison (one set for single family homes and one set for multiple family dwellings). The t-statistics for each column of coefficients (shaded in gray) permit a test of the hypothesis that sales prices in the respective year were equal to prices in the Worcester market overall. The results are striking. With the exception of 1991 and 1996, sales prices of single family houses in the UPP were about the same as in Worcester as a whole.

The potential impact of the UPP on property values is much more apparent in the final two columns of the appendix table. Even as prices of multi-family dwellings were significantly lower than prices in 1988 for the remainder of the 1990s, prices in the UPP were even *lower*, particularly during the period 1992 through 1994. The collapse of property prices after the peak of the late 1980s hit central city neighborhoods particularly hard. The coefficients for the UPP can be interpreted as the amount of depreciation or appreciation in a particular year within the UPP relative to the city as a whole, once an initial UPP discount of seven percent is taken into account (the coefficient on the UPP constant, or δ_0). The results suggest that prices on homes in the UPP were 25 to 35 percent (and even 50 percent) below the depressed levels of the remainder of the city during the early 1990s. After the recovery of the mid-1990s, prices for this kind of housing in the UPP neighborhood are not significantly different from prices in the remainder of the city.

Figure 11 graphs these results. First, it is noteworthy that prices of the small number of single family houses in the UPP continue to lag behind the prices for Worcester as a whole. Second, the recovery of two and three family housing is evident in the annual indices as well for both Worcester and the UPP neighborhood. The graph clearly illustrates the relative recovery of housing in the UPP by about 1996 with the exception of a few weak years at the end of the 1990s. Prices in the UPP have shared in the recent appreciation since 2000, with particular strength during the past three or four years.

The results of the examination of the repeat sales indices suggest that the UPP neighborhood experienced significant catch-up after the collapse of property prices in the

neighborhood in the early 1990s. One weakness of the repeat-sales analysis is that it is limited to a relatively small number of properties. The number of repeat sales for single family homes was only 57 and the number for multi-family homes was 380.¹⁶ The other weakness of this analysis is the comparison of the UPP with Worcester as a whole, rather than with other neighborhoods that are similar in all respects to the UPP with the exception of the recreational, safety and educational initiatives of the UPP.

For a finer-grained analysis that takes advantage of all of the sales in the UPP, this study turns to hedonic analysis of the submarket for two- and three-family houses and all houses. The application of the boundary model provides a comparison of the sales prices of houses within the UPP with houses that sold in adjacent neighborhoods. Using GIS techniques, all parcels that sold within 300 meters as well as within 500 meters of the UPP target area boundary line were identified as the two samples for the hedonic analysis. Figure 6 illustrates the inner and outer boundaries of the larger sample area (with a width of 1,000 meters). The 300 meter buffer includes an area of one to one and one-half blocks on either side of the boundary. In total, the area is about 840 parcels of land, of which 310 include houses that were sold one or more times during the study period. The 500 meter buffer includes about two blocks on either side of the boundary. In total, this buffer includes about 1,350 parcels of land. 570 of these parcels include houses that were sold during the study period. About an equal number of properties on either side of the boundary were sold during the period of the study.

As noted above, the specification of equation (5) includes three measures of local environmental amenities: proximity to a brownfield (within 100 meters), proximity to properties that were renovated by the MSC (within 50 meters) and the assault rate per 1,000 residents.¹⁷ The housing characteristics include presence of an attic, a porch or outbuildings; the age of the house; the number of baths and bedrooms; the size of the lot and the floor area of the house. Finally, the specification of the time-varying UPP interaction terms included five variables for various periods of property sales. Because of the small number of single family homes, the estimation included a sample of two and three family houses and the full sample of all houses. In all cases, dummy variables controlled for the type of house. The base case is a three-family house. The dependent variable (the price at the time of sale) was deflated with the appropriate quarterly index of housing prices. Thus, the hedonic estimation is of real housing prices measured in terms of the values prevailing in 1988-1990.

The outcomes of the hedonic regressions are presented in Table 3. The results are presented in four columns. First, the analysis used buffers on either side of the UPP boundary of 300 meters and 500 meters. These buffers are applied to a subsample of two- and three-family dwellings and the full sample.¹⁸ The Box-Cox transformation obscures

¹⁶ These sales in turn concerned only 35 homes in the neighborhood and 200 duplexes and triple-deckers.

¹⁷ This specification excluded from the analysis the properties that were actually the subject of CDC renovation. In addition, prices were deflated using a three-quarter moving average of the repeat sales indices.

¹⁸ Likelihood ratio tests confirmed with wisdom of using the flexible Box-Cox functional form. The tests rejected the linear specification ($\lambda=1$) and the log-log specification ($\lambda=0$) at all conventional levels of significance.

the quantitative impact of the independent variables. To clarify the true importance of the variables, the estimated implicit market price for each characteristic is also included in Table 3. The estimated price is for the mean value of each continuous variable and for a value of one for the dichotomous variables.

Most of the variables capturing local amenities and structural characteristics are of the correct sign. Those that are significantly non-zero include presence of an attic and outbuildings, the number of bedrooms and the floor area. An additional bedroom, for example, would enhance the value of a home within either buffer from \$1,500 to \$3,600 in terms of 1988 housing prices. Each square foot of floor area costs from \$6 to \$7. Each attic is valued from \$15,000 to \$30,000.

Neighborhood characteristics and local amenities and disamenities also have a strong influence on housing prices in this analysis. The coefficient on the assault rate per 1,000 residents is the most precisely measured for all of the neighborhood characteristics. The narrow range of -\$817 to -\$856 reflects the precision of the estimates. The assault rate ranges from 14 in the safest area to 56 in the most dangerous area of the 500 meter buffer sample. The difference of 42 implies a discount of \$32,000 ($42 \times \841) in the price of a two- or three-family house as one moves from the safest to the most dangerous areas in the UPP neighborhood. That is about one-quarter of the average price of a home. The coefficient on proximity to a brownfield implies a market discount that ranges from \$5,000 to \$15,000, although it is not estimated with much precision. Finally, proximity to a property renovated by the Main South CDC did enhance the value of a property sold during the period, but the amounts are relatively modest and are not estimated with precision.

Table 3 also presents the test of the capitalization hypothesis as the t-test on the coefficients of time-varying interaction terms that take on the value of one for properties located within the UPP target area during various periods. These results are striking in two dimensions. First, they confirm that for the entire period, location within the UPP neighborhood (the coefficient on Inside the UPP, which is constant for all properties) reflects the degree of deterioration in prices during the early 1990s that is evident in the results from the analysis of repeat sales. This early UPP discount ranges from \$17,000 to \$28,000. The impact of the UPP initiative is tested in the time-varying coefficients with the dichotomous variables for these periods: 1996-1998 (just after its inception); 1999-2001; 2001-2002; 2003-2004; and 2005. For the entire period, the interaction is positive. It also rises substantially over time. For the last three years, it is significantly different from zero. By the end of 2005, the UPP initiative had virtually overcome the steep (relative) depreciation of the early 1990s and prices within the UPP were about equal to prices just outside of the UPP.¹⁹ Capitalization over time has been strongly positive.

Conclusions

¹⁹ For example, the estimated premium on a home selling in 2005 reported in column three is \$22,176. This premium almost offsets the UPP discount of \$28,000 captured by the coefficient on Inside the UPP.

This study examines the impact of the University Park Partnership on the neighborhood surrounding Clark University across three dimensions of the market for housing. The establishment of the UPP apparently prompted an upsurge in homeownership. It may have coincided with an increase in the stability of ownership and reduced turnover of properties in the neighborhood. The analysis using the repeat-sales price indices and the hedonic pricing models points to a strong capitalization effect, which has been most apparent in the recent past. This may be occurring because both the longer term positive impacts of activities are now being felt and knowledge about the programs has become more widespread. The comparison of housing price indices for the period 1988-2005 highlight the severe collapse in housing prices in the region during the early 1990s as well as the recent recovery. For the Main South neighborhood and similar central-city neighborhoods in Worcester, recovery of prices and stability of the market for traditional duplexes and triple-deckers is an important component of improving the quality of the neighborhood.

The hedonic pricing model results emphasize the parcel-level, spatially-explicit local amenities and disamenities associated with the Main South neighborhood. By focusing on property sales that border on the boundary of the UPP target area, we could more directly compare properties in similar neighborhoods that differ only by the treatment effect of being within the UPP target area. The results show that once other locational and structural attributes are controlled for, inclusion within the UPP target area has increased sales prices. The benefits of the UPP have been capitalized into higher property values.

The analysis of capitalization is only the beginning of an assessment of the value of the UPP initiative for both Clark University and the UPP neighborhood. One important issue is whether the change in the mix of neighborhood attributes has affected who chooses to live in the UPP neighborhood. Most residents in the neighborhood are and will continue to be renters. Census data are at this point are inadequate to document whether the number of two-parent families, the average occupational qualifications and other indicators of the background of residents have changed since 1996. All of these indicators are also associated with household incomes. One ongoing concern of the Main South Community Development Corporation, residents of the neighborhood and Clark University is maintaining the affordability of housing, even as initiatives of both Clark and the MSDC strive to improve the quality of the neighborhood. Both issues of changes in the composition of neighborhood residents and the affordability of housing require further study.

If homeownership does become more widespread in the UPP, some share of the benefits of capitalization would accrue to residents of the neighborhood.²⁰ Presumably the promise of further appreciation (or stability of prices in the face of a general downward trend) would provide further incentives to owner-occupants to maintain property and monitor tenant quality. Although a detailed assessment of this issue is beyond the scope of this paper, we can ask what share of the appreciation from 2001 through 2005 increased the wealth of owner-occupiers in the UPP. Table 4 provides an overview of the

²⁰ We thank Raphael Bostic for raising this important policy question.

amount of appreciation realized as capital gains from sales during the period 2001 through 2005.²¹ Sixty percent of the 125 sales were by those listed on the property tax rolls as owner-occupiers at the end of 2001. Owner-occupiers of duplexes and triple-deckers experienced greater appreciation than owners resident outside of the UPP. Overall, the owner-occupiers secured over \$11.5 million in gains from the sale of their property. Owners of property in the UPP who resided elsewhere in Worcester gained another \$2.8 million. The remaining \$4 million was spread mostly among residents of towns adjacent to Worcester.

The period for this study ends just at the peak of the housing market in the fall of 2005. As Figure 8 indicates, the creation of the UPP coincided with the beginning of a nine-year appreciation of housing prices in the Worcester housing market. Since 2005, various estimates place the decline in the prices of single family homes in Worcester County at five percent or more. A final crucial test of the effectiveness of the UPP program is whether it is also effective in stabilizing property values in the face of such price declines.

²¹ Only properties identified as owner-occupied according to the city property tax rolls of 2002 were included in this comparison. Repeat sales of properties were thus excluded.

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Tables and Figures

Table 1

Clark University's Holdings of Property in the Main South/University Park Neighborhood

| Land Owner | Total valuation (in \$1,000) | Total Number Parcels | Total area in acres | Percent valuation in 2004 | Percent Parcels | Percent Area |
|--|------------------------------------|----------------------------|---------------------------|---------------------------------|--------------------|-----------------|
| Clark University | 87,913 | 78 | 45.4 | 21.6 | 4.8 | 11.2 |
| Main South Partners of Clark | 6,093 | 59 | 15 | 1.5 | 3.6 | 3.7 |
| Main South Development Corporation | 2,908 | 35 | 5.4 | 0.7 | 2.1 | 1.3 |
| Beacon Oread partnership | 2,032 | 9 | 2.3 | 0.5 | 0.5 | 0.6 |
| Kilby-Gardner- Hammond partnership | 1,153 | 15 | 7.2 | 0.3 | 0.9 | 1.8 |
| Worcester City | 10,736 | 19 | 20.4 | 2.6 | 1.1 | 5.0 |
| All others | 302,974 | 1,497 | 324.9 | 74.3 | 90.5 | 80.1 |
| Total | 407,716 | 1,653 | 405.7 | | | |

Source: Assessment data for the City of Worcester, 2004 and communication of Clark University.

Notes: Main South Partners includes the Main South Development Corporation, the Beacon-Oread partnership, and the Kilby-Gardner-Hammond partnership. The two partnerships are redevelopment efforts, which involve both renovation and new construction, the construction of a new Boys and Girls Club facility and the development of new athletic fields.

Table 2: Summary Statistics of the Variables Used in the Statistical Analysis

| Name and description of Variable | Mean | Standard deviation |
|--|---------|--------------------|
| Neighborhood variables | | |
| Price at time of sale (in \$ US) | 128,260 | 87,455 |
| Brownfield within 100 meters | 0.07 | 0.26 |
| Assault Rate per 1,000 residents | 30.03 | 10.0 |
| Within 50 meters of a CDC property | 0.05 | 0.21 |
| Inside the University Park Partnership (UPP) | 0.51 | 0.50 |
| UPP for sales years 1996-1998 | 0.08 | 0.28 |
| UPP for sales years 1999-2000 | 0.07 | 0.26 |
| UPP for sales years 2001-2002 | 0.08 | 0.27 |
| UPP for sales years 2003-2004 | 0.07 | 0.26 |
| UPP for sales year 2005 | 0.08 | 0.26 |
| Structural features of the property | | |
| Attic | 0.08 | 0.27 |
| Porch | 0.02 | 0.14 |
| Single Family | 0.15 | 0.35 |
| Duplex | 0.20 | 0.40 |
| Outbuildings | 0.20 | 0.40 |
| Age of house at time of sale (in years) | 105 | 19.4 |
| Number of baths | 2.63 | 0.66 |
| Bedrooms | 6.60 | 2.26 |
| Size of Lot (in square feet) | 6017 | 2963 |
| Floor area (in square feet) | 2918 | 995 |

Table 3: Results of Hedonic Estimation of Sales Prices of Properties Near the Boundary of UPP for Two Sizes of Buffers

| Variable | Two- and Three- Family Houses | | | | All Houses | | | |
|--|-------------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|
| | 300 Meter Buffer | | 500 Meter Buffer | | 300 Meter Buffer | | 500 Meter Buffer | |
| | Coefficient | Est. Price | Coefficient | Est. Price | Coefficient | Est. Price | Coefficient | Est. Price |
| Brownfield within 100 meters | -115.10 (1.03) | -\$7,363 | -472.37 (1.58) | -\$15,153 | -100.98 (0.84) | -\$5,607 | -420.42 (1.65) | -\$13,282 |
| Assault Rate per 1,000 residents | -3.685 (4.90) | -841 | -9.315 (5.98) | -856 | -4.402 (5.28) | -839 | -8.958 (6.44) | -817 |
| Within 50 meters of a CDC property | 17.71 (0.17) | 1,133 | 136.06 (0.86) | 4365 | 6.37 (0.06) | 354 | 87.42 (0.58) | 2,762 |
| Inside the University Park Partnership (UPP) | -447.60 (4.13) | -28,634 | -596.06 (3.20) | -19,120 | -426.05 (3.71) | -23,658 | -534.15 (3.32) | -16,875 |
| UPP for sales years 1996-1998 | 141.75 (1.02) | 9,068 | 211.32 (0.910) | 6,779 | 108.64 (0.78) | 6,033 | 172.13 (0.85) | 5,438 |
| UPP for sales years 1999-2000 | 103.09 (0.76) | 6,595 | -51.08 (0.22) | -1,639 | 86.27 (0.64) | 4,791 | -4.45 (0.02) | -141 |
| UPP for sales years 2001-2002 | 193.92 (1.40) | 12,405 | 203.68 (0.92) | 6,534 | 185.01 (1.34) | 10,274 | 172.10 (0.91) | 5,437 |
| UPP for sales years 2003-2004 | 354.74 (3.18) | 22,693 | 336.65 (1.74) | 10,799 | 362.86 (3.21) | 20,150 | 320.94 (1.88) | 10,139 |
| UPP for sales year 2005 | 346.65 (2.74) | 22,176 | 543.74 (2.58) | 17,442 | 357.26 (2.78) | 19,839 | 529.81 (2.88) | 16,738 |
| Attic | 420.19 (3.24) | 26,880 | 509.21 (2.61) | 16,334 | 521.67 (3.79) | 28,968 | 487.98 (2.98) | 15,417 |
| Porch | 98.96 (0.62) | 6,330 | -230.17 (0.53) | -7,383 | 76.46 (0.41) | 4246 | -260.53 (0.68) | -8,231 |
| Single Family | | | | | -403.31 (1.24) | -22,396 | -557.65 (1.53) | -17,618 |
| Duplex | -70.17 (0.57) | -4,489 | -210.60 (1.10) | -6,756 | -229.36 (1.34) | -12,736 | -376.81 (1.85) | -11,905 |
| Outbuildings | 261.93 (3.62) | 16,756 | 285.80 (1.96) | 9,168 | 257.23 (3.37) | 14,284 | 266.70 (2.07) | 8,426 |
| Age of house | -22.24 | -265 | -28.91 | -229 | -7.43 | -81 | -13.87 | -58 |

Table 3: Results of Hedonic Estimation of Sales Prices of Properties Near the Boundary of UPP for Two Sizes of Buffers

| Variable | Two- and Three- Family Houses | | | | All Houses | | | |
|--|-------------------------------|------------|------------------|------------|-------------------|------------|------------------|------------|
| | 300 Meter Buffer | | 500 Meter Buffer | | 300 Meter Buffer | | 500 Meter Buffer | |
| | Coefficient | Est. Price | Coefficient | Est. Price | Coefficient | Est. Price | Coefficient | Est. Price |
| | (1.54 | | (2.53) | | (0.49) | | (1.25) | |
| Number of baths | 57.28 (0.39) | 2,582 | 368.06 (1.66) | 8,631 | -180.08 (0.89) | -7,081 | 91.87 (0.41) | 2,168 |
| Bedrooms | 111.39 (2.05) | 3,608 | 73.63 (0.93) | 1,311 | 127.88 (2.24) | 3,638 | 80.71 (1.10) | 1,446 |
| Size of Lot | -0.25 (0.67) | -0.70 | -0.05 (0.14) | -0.12 | -0.14 (0.39) | -0.37 | 0.12 (0.35) | 0.27 |
| Floor area | 2.03 (1.70) | 7.33 | 2.41 (2.04) | 6.91 | 1.99 (1.65) | 6.71 | 2.00 (1.72) | 5.75 |
| Constant | -2850.81 | | -8017.07 | | -3670.76 | | -7693.81 | |
| Likelihood Ratio Test (χ^2 with 18 degrees of freedom) | 95.1 | | 130.0 | | 133.1 | | 196.2 | |
| Estimate of Lambda | 0.64 | | 0.70 | | 0.65 | | 0.70 | |
| N | 526 | | 937 | | 604 | | 1099 | |

Source: Results of Box-Cox estimation of the hedonic relationship.

Notes: Asymptotic *t*-statistics are in parentheses. The dependent variable is the Box-Cox transformation of the sales price of the home deflated by the quarterly repeat-sales index of house values.

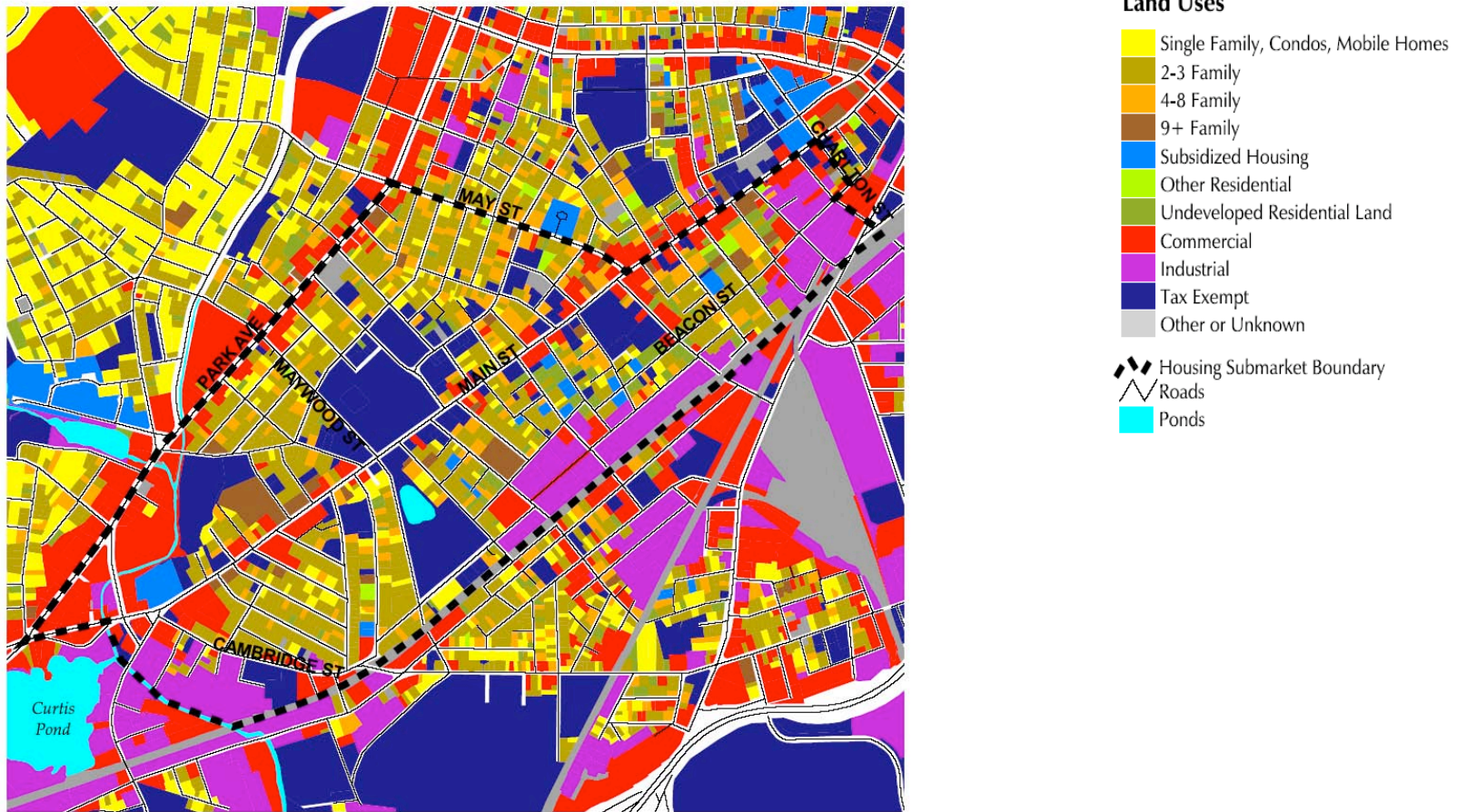
Table 4: The Distribution of Property Appreciation in the UPP: 2001-2005

| Type of House | N | Median Appreciation (\$1,000) | Mean Appreciation (\$1,000) | Median Years Owned |
|--------------------------------|----|-------------------------------------|-----------------------------------|-----------------------|
| Sales of Owner-Occupied Houses | | | | |
| Single Family | 10 | 84 | 83.8 | 5.0 |
| Two-Family | 18 | 131 | 142.2 | 5.3 |
| Three-Family | 48 | 173 | 168.4 | 5.9 |
| Sales of other Houses | | | | |
| Single Family | 2 | 91 | 90.5 | 1.9 |
| Two-Family | 7 | 84 | 90.9 | 9.9 |
| Three-Family | 42 | 157 | 144.2 | 5.2 |

Source: Warren housing sales dataset and City of Worcester property tax assessment data for 2002.

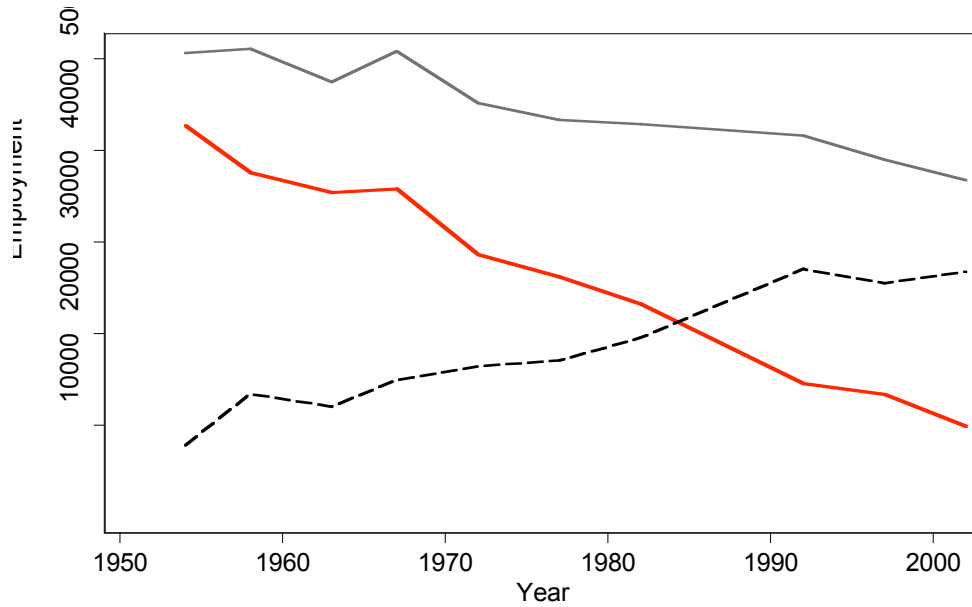
Notes: Only the first sale taking place after 2001 is included. The amount of appreciation is in nominal terms.

Figure 1: Land Use in the Main South Neighborhood

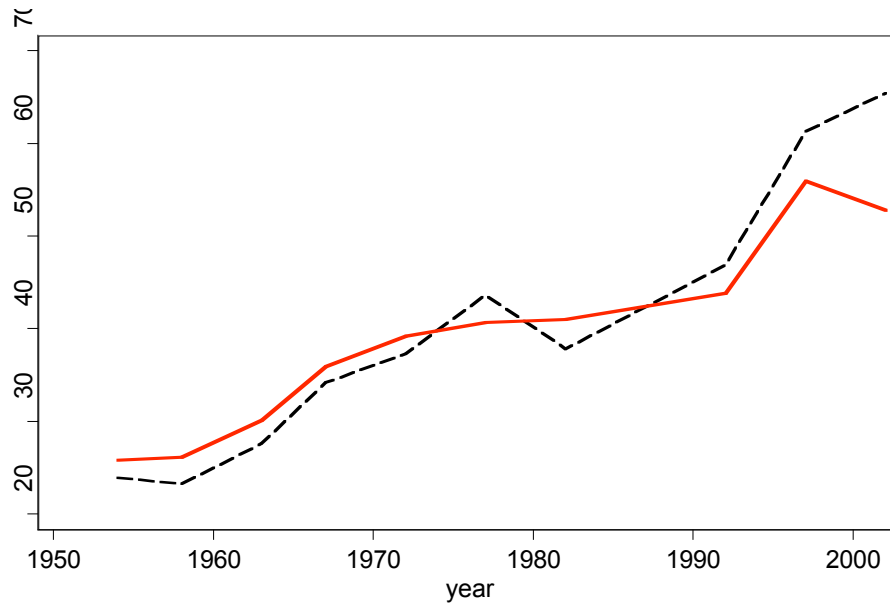


Source: RPG Associates (2002), *Housing Market Study for the City of Worcester, Massachusetts*. Worcester MA: Executive Office of Neighborhood Services. Chapter 10.

Figure 2: The Development of Manufacturing in the Worcester SMSA: 1954-2002



Total SMSA Employment ——— Employment in Worcester ———
 Employment outside of Worcester - - - - -



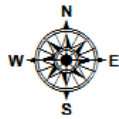
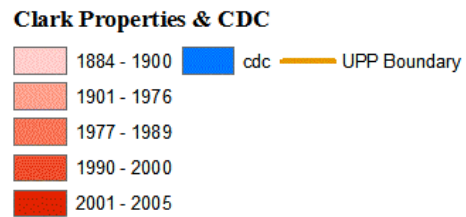
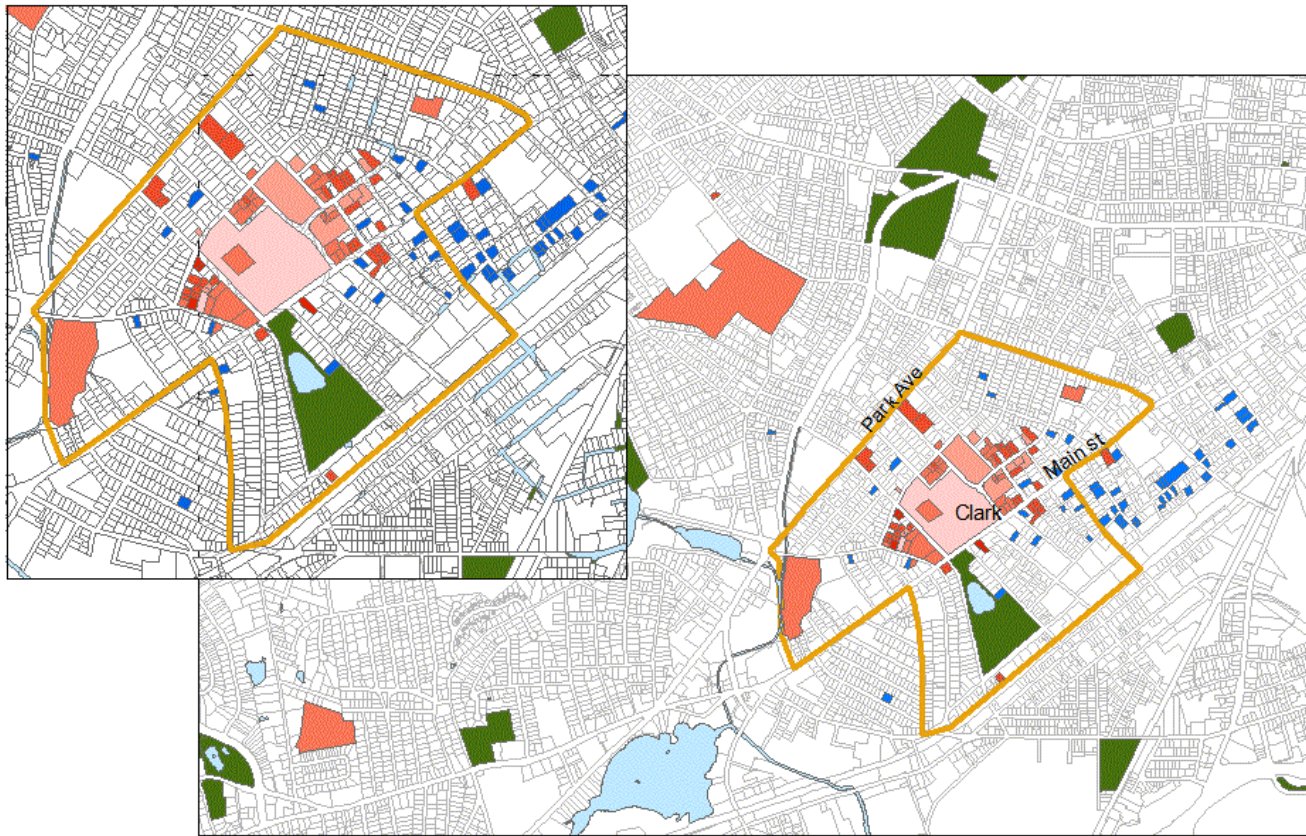
Value-Added per Employee outside Worcester - - - - -
 Value-Added per Employee in Worcester ———

Source: Censuses of Manufacturing for 1954, 1958, 1963, 1967, 1977, 1982, 1992, 1997 and 2002.
Notes: Value-added is deflated with the average cost of living for each year. The Worcester SMSA includes a few towns in southern Connecticut and several towns surrounding the central city.

Figure 3: The UPP Target Area Neighborhood



Figure 4: Clark University Property Acquisitions (1884-2005) and MSCDC Renovation and Construction Activity



Source: Communications of Clark University and the Main South Community Development Corporation; City of Worcester Property Assessment Records.

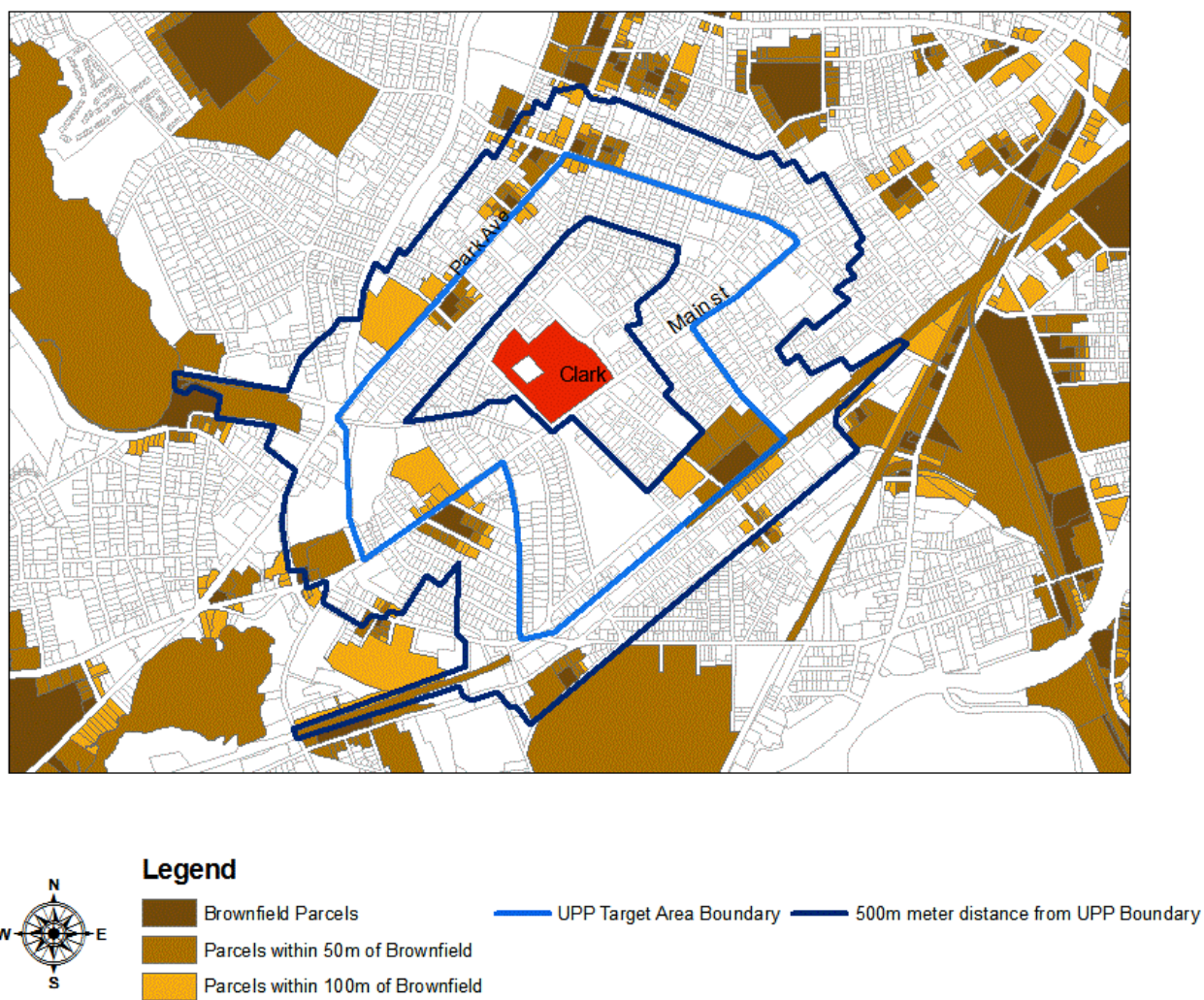
Figure 5: Sales of Property in the UPP Neighborhood and the Surrounding Area, 1988-2005



Source: Warren housing sales dataset.

Notes: The dark blue line shows the interior and exterior boundary of the 500-meter buffer around the UPP boundary (in light blue).

Figure 6: Parcels in Proximity to Brownfields in the UPP Neighborhood and the Surrounding Area



Source: Massachusetts Department of Environmental Protection.

Figure 7: An Example of MSCDC Renovation: Three-Family at 34 Oread St.



Before Renovation



After Renovation

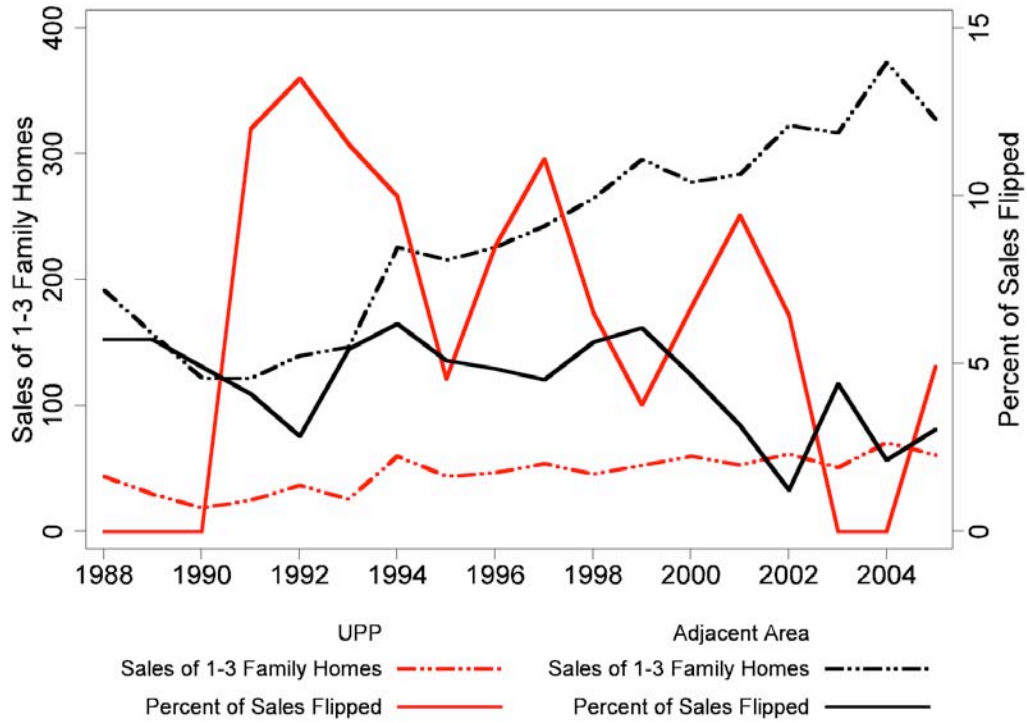
Figure 8: Sales of Houses to Owner-Occupants in the UPP and the Adjacent Area



Source: Warren housing sales dataset and City of Worcester property tax assessment data for 2002 and 2006.

Notes: Only purchases of properties still in the hands of owners in 2001 and 2005 are included. For further discussion, see footnote 12. The comparison neighborhood includes properties sold in the 3000-meter wide area immediately adjacent to the UPP on all sides. The first full year of the UPP was 1996.

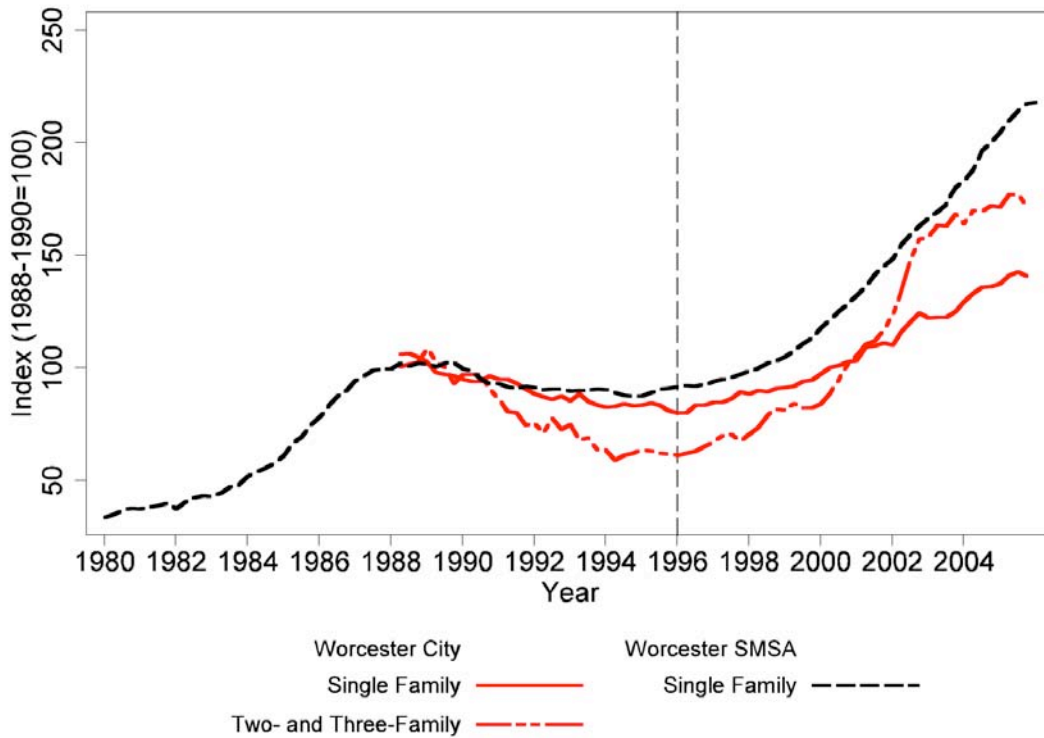
Figure 9: Property Flipping in the UPP and the Surrounding Area



Source: Warren housing sales dataset.

Notes: Flipping is defined as the sale of a property within 180 days of purchase. See HUD (2003). The comparison neighborhood includes properties sold in the 3000-meter wide area immediately adjacent to the UPP on all sides. The first full year of the UPP was 1996.

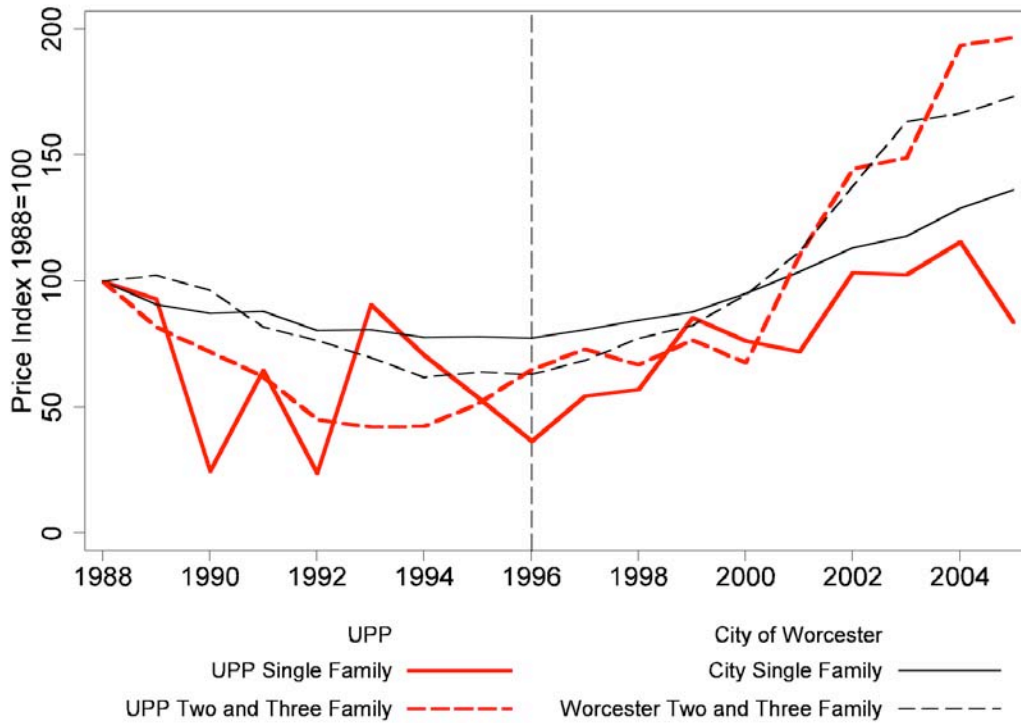
Figure 10: Quarterly Repeat Sales Indices for Single Family Homes and Two- and Three-Family Homes: Worcester SMSA and City



Source: Office of Federal Housing Enterprise Oversight repeat sales index for the Worcester SMSA (Worcester County) and quarterly repeat sales indices calculated for the City of Worcester from the Warren housing sales dataset.

Notes: The repeat sales indices calculated for Worcester use the WRS methodology outlined in Calhoun (1996). The first full year of the UPP was 1996.

Figure 11: Annual Repeat Sales Indices for Single Family Homes and Two- and Three-Family Homes: Worcester City and the UPP Neighborhood



Source; Annual repeat sales indices estimated using from the Warren house sales dataset.

Notes The repeat sales indices are calculated for Worcester using the WRS methodology outlined in Calhoun (1996). The first full year of the UPP was 1996.

Appendix Table 1: Results of Estimating Annual Repeat Sales Indices for Worcester City with Interactions for the UPP Neighborhood

| Annual Values | Single Family | | Two and Three Family | |
|---------------|---------------|-------------|----------------------|-------------|
| | Coefficient | t-statistic | Coefficient | t-statistic |
| Year 1989 | -0.10 | -4.09 | 0.02 | 0.41 |
| Year 1990 | -0.14 | -5.35 | -0.04 | -0.62 |
| Year 1991 | -0.13 | -5.12 | -0.20 | -3.49 |
| Year 1992 | -0.22 | -8.93 | -0.27 | -4.69 |
| Year 1993 | -0.21 | -9.37 | -0.36 | -6.72 |
| Year 1994 | -0.25 | -10.77 | -0.48 | -9.34 |
| Year 1995 | -0.25 | -10.41 | -0.45 | -8.63 |
| Year 1996 | -0.26 | -11.14 | -0.46 | -9.23 |
| Year 1997 | -0.21 | -9.27 | -0.38 | -7.46 |
| Year 1998 | -0.17 | -7.33 | -0.26 | -5.10 |
| Year 1999 | -0.13 | -5.53 | -0.19 | -3.78 |
| Year 2000 | -0.05 | -2.11 | -0.06 | -1.08 |
| Year 2001 | 0.04 | 1.49 | 0.11 | 2.14 |
| Year 2002 | 0.12 | 4.78 | 0.32 | 5.96 |
| Year 2003 | 0.16 | 6.04 | 0.49 | 8.57 |
| Year 2004 | 0.26 | 9.06 | 0.51 | 8.50 |
| Year 2005 | 0.31 | 10.37 | 0.55 | 8.60 |
| Constant | 0.12 | 8.92 | 0.65 | 2.82 |

| UPP Interaction Terms | Single Family | | Two and Three Family | |
|-----------------------------|---------------|-------------|----------------------|-------------|
| | Coefficient | t-statistic | Coefficient | t-statistic |
| UPP 1989 | 0.03 | 0.08 | -0.22 | -1.31 |
| UPP 1990 | -1.25 | -1.93 | -0.29 | -1.44 |
| UPP 1991 | -0.31 | -0.84 | -0.28 | -1.62 |
| UPP 1992 | -1.21 | -3.29 | -0.53 | -2.88 |
| UPP 1993 | 0.11 | 0.23 | -0.50 | -2.95 |
| UPP 1994 | -0.09 | -0.39 | -0.37 | -2.31 |
| UPP 1995 | -0.37 | -1.24 | -0.21 | -1.24 |
| UPP 1996 | -0.75 | -2.25 | 0.03 | 0.18 |
| UPP 1997 | -0.40 | -1.13 | 0.07 | 0.42 |
| UPP 1998 | -0.39 | -0.87 | -0.15 | -0.84 |
| UPP 1999 | -0.03 | -0.08 | -0.07 | -0.41 |
| UPP 2000 | -0.21 | -0.61 | -0.34 | -2.08 |
| UPP 2001 | -0.36 | -1.07 | -0.01 | -0.08 |
| UPP 2002 | -0.09 | -0.2 | 0.05 | 0.28 |
| UPP 2003 | -0.13 | -0.35 | -0.09 | -0.49 |
| UPP 2004 | -0.11 | -0.25 | 0.15 | 0.77 |
| UPP 2005 | -0.48 | -1.1 | 0.13 | 0.60 |
| UPP constant | 0.08 | 0.42 | -0.07 | -0.92 |
| adjusted R ² (N) | 0.18 (7,697) | | 0.27(3,695) | |