Subsidized Housing Investment, Neighborhood Interactions, and Local Amenities: Evidence from a Tax Credit Lottery

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Abstract

This paper examines the private response to tax incentives for residential investment as well as the nature and scope of housing externalities by exploiting the lottery structure of Missouri's Neighborhood Preservation Act (NPA). The NPA offers tax credits to homeowners and developers that improve or expand the owner-occupied housing stock in low-income areas. Taking advantage of the random assignment of NPA tax credits and detailed property-level data, we find that the program increases construction activity over and above what would have occurred in its absence. There are positive but modest and highly localized spillovers of NPA-subsidized housing investment on neighbors' investment behavior and property values. The results shed light on the importance of neighbor interactions and amenity effects in local housing markets.

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1 Introduction

In recent decades, the federal government as well as many state and local governments in the U.S. have introduced programs that offer tax credits, grants, or low-interest loans to households or developers for housing construction, maintenance, and renovation projects. These programs are often justified on the grounds that such projects have positive spillovers on neighborhoods. Not only might one homeowner's investment activities increase property values of nearby homes, but they might also spur neighbors to invest more themselves. Many rehabilitation programs are targeted at distressed neighborhoods, where both increasing property values and instigating neighborhood revitalization efforts may be particularly important. However, a major concern regarding these programs is that they could merely crowd out unsubsidized private investment in housing. That is, some or even all of the investment subsidized by the government might have happened even in the absence of any government subsidy.

This paper examines the impacts of Missouri's Neighborhood Preservation Act (NPA) in the City of St. Louis between 2003 and 2010. The NPA offers tax credits to homeowners and developers that improve or expand the owner-occupied housing stock in low-income communities. Because there is a limit on the amount of credits that can be awarded, the state uses a lottery to determine which applicants receive the credits.

Taking advantage of the random assignment of NPA tax credits and detailed property-level data, we find evidence that the program stimulates construction activity that would not have otherwise occurred. Relative to the homeowners and developers whose applications for tax credits were denied, those whose applications were approved were issued nearly two-thirds more building permits during the two-year window credit recipients had to complete their projects. This difference in permitting activity shrinks little in subsequent years, which suggests that the credits are not merely shifting the timing of projects. The program also appears to crowd out less private construction activity in declining neighborhoods relative to growing neighborhoods.

Using data from St. Louis' Assessor's Office, we also consider the impacts of the NPA's tax credits for housing investment on property values. For every $1 in NPA credits authorized to properties in the data, we find that, compared to those denied credits, tax credit recipients' city-assessed property values increase by about $0.50 on average. Tax credit receipt is also associated

with a higher probability of subsequent sale and higher sale prices. Overall, the results suggest that while there is a significant degree of crowd out, a large fraction of the money spent under the program is directly capitalized into home prices. Again, however, there is important heterogeneity across neighborhoods in the degree to which the tax credits are reflected in property values.

We go on to study the external effects of the housing investment spurred by the NPA, and find only limited evidence that the impacts of the program extend beyond the properties that received tax credits. The results suggest that subsidizing construction at one property has positive, but modest effects on the number of building permits issued to owners of neighboring properties. To the extent that there are positive impacts, they are confined to properties within about 100 feet. Neighboring property values also increase, but again the effects are modest, imprecisely measured, and limited in geographic scope. The results suggest that housing subsidies like those provided under the NPA are unlikely to have meaningful spillover effects within neighborhoods.

Our findings provide new insights into the effectiveness of government efforts to promote housing investment as well as the promise such efforts may hold in achieving broader neighborhood revitalization goals. The exogenous variation in housing investment induced by the NPA coupled with rich property-specific information allow us to shed new light on the nature and scope of housing externalities, which are frequently a core justification for subsidizing construction and rehabilitation activity. Overall, our results point to the potential for government policies to encourage housing construction and rehabilitation, but at the same time highlight the limits of such policies in spurring broad-based neighborhood change where it would not happen otherwise.

While programs similar to Missouri's NPA exist throughout the U.S. and abroad, what evidence exists on their effectiveness is mixed. Galster (1987), Galster and Hesser (1988), and Whalley (1988) evaluate a Minneapolis program administered in the late 1970s that subsidized property maintenance through loans and grants. They find that the program stimulated private upkeep expenditure above and beyond what would have occurred without the subsidies. They also find that subsidized reinvestment by one household prompted new unsubsidized spending on housing by neighboring households. Meanwhile, Galster et al. (2006) and Rossi-Hansberg et al. (2010) examined the Neighborhoods in Bloom program in Richmond, Virginia, which allocated public funds to improving the existing owner-occupied housing stock and constructing new mixed-income housing in certain neighborhoods. Both studies find that land prices in affected neighborhoods

rose faster than in control communities and some evidence that investments had spillover effects on nearby areas. However, examining a program in the United Kingdom, Boyne et al. (1991) find that rehabilitation grants largely substitute for private renovation investments, paying for work that would have been undertaken regardless of the grant. They conclude that the program ultimately acted merely as an income transfer to grant recipients.[1]

Outside of the fairly small literature on housing maintenance and renovation incentives, a larger literature considers the impact of new subsidized homebuilding on neighborhood conditions. For example, Ellen et al. (2001) examine the extent of spillovers associated with construction of new subsidized owner-occupied housing in distressed neighborhoods in New York City. Consistent with the presence of housing externalities, they find that prices of properties near construction sites rose. Other studies have considered the impact of new and rehabilitated rental housing subsidized by the federal government's Low-Income Housing Tax Credit. These studies have also found important positive impacts of subsidized housing investment on neighborhoods (Baum-Snow and Marion 2009, Freedman and Owens 2011, Diamond and McQuade 2018). However, many place-based housing programs are also associated with a substantial amount of crowd out of private funds (Sinai and Waldfogel 2005, Eriksen and Rosenthal 2010, Freedman and McGavock 2015).

Much of the literature on the effects of subsidized housing investment in general, and on tax incentives aimed at improving the owner-occupied housing stock in particular, relies on difference-in-differences approaches, comparing changes in conditions for properties or neighborhoods that receive subsidized investment to the same changes for observably similar properties or neighborhoods that do not receive subsidized investment. A major concern with this approach is that it is difficult to know whether treated properties or neighborhoods were similar to controls along unobserved dimensions, and whether, absent the treatment, they would have followed the same trajectory. All else being equal, we might expect developers and homeowners to apply for more subsidies in locations with better future prospects; in fact, we find that NPA applicants that lose the lottery apply for substantially more building permits than other observably similar property owners in St. Louis. In a difference-in-differences framework that does not exploit the experimental variation afforded by the NPA, this endogeneity tends to inflate estimates of program impacts on treated

[1] See Kain and Apgar (1985), Galster (1987), and Rossi-Hansberg et al. (2010) for theoretical treatments of rehabilitation incentives.

properties. Spillovers attributed to subsidies in a non-experimental setting could also be driven by unobserved heterogeneity across neighborhoods; to the extent that locations near those that receive subsidies also have relatively strong future prospects, we might ascribe improvements in the housing stock around a property that receives subsidies to externalities, when in reality the observed improvements would have occurred regardless.

Exploiting the lottery for tax credits under Missouri's NPA, we can overcome these endogeneity problems and more credibly identify the impacts of the program's tax credits on individual properties and their neighborhoods. One might expect there to be externalities associated with subsidized housing investment due to neighborhood effects in renovation decisions (Ioannides 2002, Helms 2012), spillovers on nearby house values from improvements in property conditions (including, for example, the rehabilitation of dilapidated structures and the elimination of vacant lots), and the fact that homeownership itself could encourage further private investment in local amenities and social capital (DiPasquale and Glaeser 1999).[2] In the case of Missouri's NPA, we find that while program dollars crowd out relatively little private investment, the external impacts of subsidized housing construction and rehabilitation are modest.

The paper is organized as follows. The next section provides background on Missouri's NPA and the lottery system that determines which applicants receive tax credits for new construction or rehabilitation of owner-occupied housing in the state. We describe the data and provide descriptive statistics in Section 3. In Section 4, we present results on the effects of the NPA on construction activity and property values among lottery participants. We examine the external effects of NPA-subsidized investment in Section 5. We conclude in Section 6.

2 Missouri's Neighborhood Preservation Act

2.1 Program Structure

Missouri's NPA was authorized under Senate Bill 20, which was signed July 8, 1999 and went into effect January 1, 2000.[3] Its primary goal is to protect against neighborhood deterioration in the

[2] However, the marginal households induced into homeownership by the program may generate smaller externalities than the average homeowner (Eriksen et al. 2010). New housing supply could also diminish incentives for existing homeowners to invest in neighborhood-specific social capital (Hilber 2010).

[3] Information in this section is drawn from Missouri's Department of Economic Development website (http://ded.mo.gov) and from conversations with program staff.

state's poorest communities. The NPA authorizes the use of state tax credits to offset part of the cost of investment in maintenance, repairs, or new construction of housing in low- to moderate-income communities. The program is limited to property that is currently owner occupied or that will be sold to an owner occupant.

Unlike preservation programs in other states, eligibility is not contingent on being an historic site (i.e., listed on a historical site registry) or on the income of the taxpayer. Instead, eligibility for the tax credits is based entirely on the location of the property. In general, the size of the potential tax credit varies on the basis of initial income levels in the area, with properties located in so-called "qualifying areas" eligible to receive larger tax credits than those in so-called "eligible areas." For the purposes of our analysis, we focus on projects in the City of St. Louis, the entirety of which is qualifying by virtue of being designated a "distressed community," or a municipality with median household income below 70% of that of the metropolitan area in which it is located. The household income data used for designation during the sample period were derived from the 2000 Decennial Census.[4]

Homeowners or developers building new owner-occupied housing in qualifying areas can receive tax credits amounting to 15% of eligible costs, with credits not to exceed $40,000 per residence per ten year period.[5] Those investing in "substantial rehabilitations" of owner-occupied housing in qualifying areas can receive tax credits of 35% of eligible costs, with minimum costs the greater of $5,000 or 50% of the purchase price; for substantial rehabilitation credits, the tax credit cannot exceed $70,000 per residence per ten year period. Finally, those investing in "non-substantial rehabilitations" of owner-occupied housing in qualifying areas can receive tax credits amounting to 25% of eligible costs, with minimum costs of $5,000 and tax credits not to exceed $25,000 per residence per ten year period. Appendix Table A1 provides samples of eligible and ineligible expenditures for new construction and rehabilitation projects under the program.[6]

[4] According to the 2000 Decennial Census, at $27,156, the median household income of the City of St. Louis in 1999 was 60% of the median household income of the Metropolitan Area of St. Louis of $45,432.

[5] According to the 2008-2012 American Community Survey, the median family income in City of St. Louis is $43,503. Assuming this represents entirely wage and salary income, that there are two dependent children in the family, and that the family has no other deductions or credits, this family would have paid $1,275 in state income taxes in 2012 (Missouri's personal income tax has ten brackets and a top rate of 6%).

[6] Taxpayers cannot combine the program with other state or federal loans or tax credit programs, with the exception of the state's Historic Preservation Tax Credit program. If Historic Preservation tax credits are claimed, the maximum available credits under the NPA are the lesser of 20% of eligible costs or $40,000. It is possible that those denied NPA tax credits seek funding from other public sources for planned new construction or rehabilitations. To the extent that we do not observe and cannot control for applicants' financing from other public sources, this substitution will tend

Recipients of NPA tax credits have two years from the date their application is approved to complete their projects, and the credit must first be applied against the tax liability for the tax year in which the credit is issued. Taxpayers may apply any excess credit toward their tax liability for the three prior years as well as the five subsequent years. While the NPA tax credit must be used for the property listed in the application and is nonrefundable (i.e., it cannot reduce a taxpayer's tax liability below zero), it is sellable/transferrable to another person or entity.

2.2 Tax Credit Lottery

The NPA authorizes $16 million in tax credits statewide each year, $8 million of which is earmarked for qualifying areas. Demand for credits has exceeded supply every year in qualifying areas.[7] To disperse the limited NPA funds to proposed projects, the state's Department of Economic Development (DED) uses a lottery. Specifically, the DED assigns a random number to all applicants conditional on satisfying all the eligibility requirements. It then ranks the applications based on this random number. Working down the list, it awards credits, deducting the amount of the credit from the total allocated to eligible or qualifying areas depending on the location of the project. When all the credits are exhausted or it runs out of applications, the DED stops.

The lottery system for awarding credits under the NPA provides an ideal setting to examine the impact of tax incentives for housing investment on neighborhoods. Indeed, unlike with state allocations of other types of tax credits that are also often in excess demand, Missouri's NPA credits will not necessarily be allocated to those projects that program administrators believe might have the highest likelihood of success or the greatest social benefit.[8] Rather, they are randomly assigned to those applicants who meet the eligibility criteria. Projects for which homeowners or developers applied for credits but were turned down provide a natural comparison group to projects for which

to bias our estimates of the impacts of the NPA toward zero.

[7] Demand has not exceeded supply each year in eligible areas, which have higher median household incomes. Because the probability of winning the lottery was higher for applicants in eligible areas relative to qualifying areas every year, some developers and homeowners in St. Louis may have entered their applications into the eligible pool even though they were technically in a qualifying area. Unfortunately, we do not observe which pool into which applications were initially entered. Therefore, in the main analysis, we exclude NPA projects located in eligible block groups in St. Louis. However, including these projects has little effect on the main results (results available upon request).

[8] Projects perceived as having a high probability of success may also be more likely to be inframarginal. If that is the case, it could help to explain recent findings pointing to a substantial amount of crowd-out associated with place-based housing programs (Eriksen and Rosenthal 2010).

homeowners or developers applied for and received credits.

The randomization thus allows us to identify the impacts of tax incentives for housing investment more credibly than past studies, which have typically relied on difference-in-differences approaches (Ellen et al. 2001, Galster et al. 2006, Ellen and Voicu 2006, Schwartz et al. 2006, Ellen et al. 2007, Rossi-Hansberg et al. 2010). A concern in such studies is that the treatment is endogenous to outcomes of interest. This might happen, for example, if tax credits are awarded disproportionately in areas with better future prospects. Ignoring this endogeneity is likely to bias upward the estimated effects of subsidies at the property level as well as at the broader neighborhood level, as community improvement that would have happened regardless will be mistakenly attributed to government subsidies and their spillovers.[9]

3 Data

3.1 Sources

We use data from several sources. The first is Missouri's Department of Economic Development (DED), which publishes on its website information on areas eligible to receive the NPA tax credits. We obtained data on awarded NPA tax credits from the Missouri State Government's Accountability Portal, a website created to improve the transparency of the state government's programs and provide information on the uses of taxpayer money. Missouri's DED also provided supplemental information on NPA credit awards that were not claimed as well as information on the location of each proposed project, which allowed us to use commercial GIS software to assign each project to a census block. Finally, the DED provided us a list of the locations of all the projects that lost the lottery, which we also assigned to blocks.

The tax credit data cover fiscal years 2000-2010, but we focus on applications from 2003-2010 in the main analysis. The list of denied applications prior to fiscal 2003 contain some applications that were denied because the projects were ineligible rather than because they lost the lottery; based on the information available, it is not possible to identify those that never entered the lottery in those years. Therefore, to ensure that the sample consists only of those applicants who actually took part

[9] Notably, if there are important housing externalities that contaminate the control group in these studies, estimates based on a difference-in-differences strategy could also potentially understate the impact of such programs.

in the lottery, we drop applications submitted before fiscal 2003.

We restrict attention to projects in the City of St. Louis, where we could obtain extensive property-level data. We first matched each approved and denied project to parcels as delineated by Saint Louis' Assessor's Office, which allowed us to obtain a city parcel identifier. To match NPA projects to parcels, we began with exact address matching using a city-provided API that facilitates searches on exact street numbers and names.[10] When that failed (typically due to an error in the address reported on an application), we used the Google Maps API to assign coordinates to addresses, then GIS software together with shapefiles from the city to locate the parcels in which each was located.

Using the parcel identifiers, we could match applicants to data on issued building permits, assessments, and sales from the St. Louis Building Division and the Assessor's Office. The building permit data include complete information for 1990-2018.[11] Our primary source of information on property values is derived from tax assessment data provided by the City of St. Louis' Assessor's Office. The data include individual property assessments each year between 1997 and 2013. The Assessor's office generally assesses properties in the city every odd year unless there is new construction, the property undergoes major rehabilitation, or the property is severely damaged or destroyed (for example, as a result of flood, fire, or demolition). The Assessor's Office attempts to capture the fair market value of properties in its assessments using information on new construction that has occurred, sales prices of comparable properties located nearby, the condition of properties, and other factors.[12] The Assessor's Office also maintains records of housing transactions and sale prices, which we use in supplementary analyses of the effects of winning vs. losing the NPA lottery.

Finally, we extracted information from the 2000 Decennial Census on a host of census block-level demographic and housing characteristics, including population, racial and ethnic composition, the age distribution, the number of housing units, the share occupied, the share vacant, the share owner

[10] See https://www.stlouis-mo.gov/government/departments/information-technology/web-development/city-api/index.cfm.

[11] We exclusively use data for building permits, which are required for new construction and major alterations to structures. Larger projects that would have measurable direct effects as well as potentially spillover effects on nearby properties' values are likely to require such permits. Data for other types of permits (e.g., demolition, occupancy, electrical, mechanical, and plumbing permits) are also available, but not for the full time horizon under consideration. We nonetheless present results for these other types of permits in supplementary analyses in Section 4.1.

[12] Notably, the data provided by the Assessor's Office is the "assessed value," which is a fraction of the market value assigned by the Assessor's Office that depends on the type of the property in question (e.g., residential, agricultural, commercial). We adjust the assessed values using these fractions to reach estimates of market values.

occupied, the share renter occupied, and the share of the population in group quarters. We use this information to test whether neighborhood characteristics are balanced across approved and denied applications as well as to construct control variables for use in some of the regressions.

Notably, because the lottery takes place yearly, randomization is conditional on year of the lottery, with a different potential probability of winning each year. In principle, this could lead a sample pooled across several years to be unbalanced on covariates. However, roughly the same fraction of applications (between 89% and 97%) were denied each year between 2003 and 2010, and as discussed in the next section, covariates are relatively balanced despite the pooling across years as well as the restricted attention on St. Louis.[13] Additionally, as shown in robustness tests, the results are qualitatively similar when we stratify the sample by year.

3.2 Descriptive Statistics

Between 2003 and 2010, there were 286 approved NPA applications and 3,860 denied NPA applications for qualifying projects within the City of St. Louis. Figure 1 shows the locations of approved and denied applications in the city; the boundaries in the maps delineate city-defined neighborhoods, of which there are 79. It is clear from the maps that, while there are substantially more denied projects than approved projects, their spatial distribution is very similar. Indeed, a disproportionate number of both approved and denied applications originate in neighborhoods just south of downtown (including Lafayette Square, McKinley Heights, and Benton Park) and on the west side of the city (including Skinker/DeBaliviere, West End, and Hamilton Heights).

The top panel of Table 1 describes the characteristics of denied and approved applications' locations using 2000 Decennial Census data at the census block level. The columns break out denied and approved applications and reports for the census blocks in which they are located average housing characteristics, including total housing units, share occupied, and share owner occupied, as well as average demographic characteristics, including population, share female, share black, share under age 18, median age, total households, total families, and share in group quarters.

The typical NPA application in St. Louis comes from a block with roughly 45 housing units,

[13] In fact, they are slightly more balanced than in several of the individual years, as randomization together with the law of large numbers (and not just randomization alone) result in treated and control groups that are balanced (Hoxby and Rockoff 2004).

over 20% of which are vacant. Of those housing units not vacant, slightly more than 40% are owner-occupied on average. The average application is also on a block with around 85 total residents, of whom approximately two-thirds are black.[14]

While it is clear based on columns (1) and (2) in Table 1 that denied and approved applications originate from blocks that are on average very similar, there are some notable differences. Approved applications are located on blocks with slightly larger populations and with higher homeownership rates. However, none of the differences in block characteristics for approved and denied applications in qualifying areas are statistically significant at the 5% level. Further, while the difference in homeownership rates is statistically significant at the 10% level, we would expect that, given the number of characteristics we are comparing, at least a few differences would show up as significant. Importantly, though, all the differences in baseline block characteristics between approved and denied projects are small in magnitude.

In the second panel of Table 1, we report the average assessed property values and sales prices in 2002 among those properties that were approved and denied NPA tax credits. The average property value was just over $54,000 for those properties that were authorized credits, about $4,000 less than that for denied credits. However, the variance in property values is also substantial, such that we cannot rule out that average property values are the same for both groups; in fact, the p-value for the difference is 0.90. Among those properties that transacted in 2002, the difference in sales prices is larger (at about $9000), but also is not statistically significant (p-value = 0.82).

The final panel of Table 1 reports information on the mean and median credit authorized, the fraction of authorized projects issued any credits, and the mean and median credit issued conditional on being claimed. The mean credit authorized to winning applications in St. Louis was $35,715 while the median credit authorized was $33,210. Approximately three-fourths of winning applicants claimed at least some of their credit between 2003 and 2010; the mean (median) credit issued was $22,153 ($20,665). Notably, relative to the average initial property values, the magnitudes of these credits are large.

[14]The City of St. Louis as a whole was 51% black in 2000. In interpreting the numbers in Table 1, it is important to remember that the data are at the project level as opposed to the block level, such that some blocks are represented multiple times.

4 Direct Effects of NPA Tax Credits

4.1 Building Permit Issuance

New construction as well as any structural changes or major alterations to existing buildings require building permits from the city's Building Division. The majority of work that would qualify under the NPA program would require a permit of some type; we focus on permits for new construction or major structural alterations (i.e., building permits). The city also issues demolition permits, occupancy permits, electrical permits, mechanical permits, plumbing permits, and permit waivers. Some of these other types of permits are not consistently reported by the Building Division for the full sample period, so for much of the analysis we focus on building permits. However, we show results for these other types of permits in supplementary tests.

Between 2003 and 2010, the Building Division of the City of St. Louis issued 0.04 building permits each year on average to each parcel in the city, or about one building permit every 25 years. Focusing on parcels for which an NPA application was received, the average number of building permits issued the year in which the application was submitted was 0.37. As can be seen in Table 2, among those projects for which credits were denied as a result of losing the lottery, an average of 0.35 building permits were issued the year of the application. That is, relative to any randomly selected residence in the city, those denied credits are nonetheless more likely to undergo major construction or rehabilitation. This points to the endogeneity of applications themselves; while those developers and homeowners who win and lose the credits are chosen at random, the pool of applicants is not representative. Those that enter the lottery have a greater underlying propensity to undertake projects, and even those that lose the lottery apply for permits at a much higher than average rate.

Meanwhile, projects authorized credits were issued 0.60 building permits in the year of the application on average, or about 0.25 permits (71%) more than those denied credits. The subset of approved projects for which credits were claimed ("completed" projects) were issued 0.72 permits on average, over twice as many as those that were denied credits. Expanding the window of time since the application, we see that (mechanically) the number of building permits issued to both approved and denied applicants increases. However, the gap in permitting between approved and

denied projects not only persists, but becomes larger. This can also be seen in Figure 2, where we plot the average number of permits issued to approved and denied applicants in each of the five windows of time. Overall, these results suggest that credits induce additional construction activity above and beyond what would have occurred in the absence of the credits.[15]

As can also be seen in Table 2, the impacts do not appear to be concentrated in any particular type of permits, but rather are similar across most types. For example, during the two-year window winning applicants have to complete their projects, projects whose applications were approved obtain 55% more occupancy permits, 23% more electrical permits, and 38% more plumbing permits. However, the difference in permit issuance to approved projects and denied projects is only statistically significant for occupancy permits, and is smaller in both absolute and percentage terms for the relatively less common demolition permits and mechanical permits.[16]

The lottery structure of Missouri's NPA helps to ensure that the characteristics of approved and denied projects are similar. Nonetheless, we can control for each proposed project's block characteristics, which may help to improve the precision of the estimated effects. In Table 3, we present the results of reduced-form regressions of the form

$$Permits_{ib(t+\tau)} = \beta_0 + \beta_1 Approved_{it} + \mu_t + \mathbf{X}_b\mathbf{\Omega} + \varepsilon_{ib(t+\tau)} \quad (1)$$

where $Permits_{ib(t+\tau)}$ is the number of permits issued to property i in block b in the time window of length τ beginning in year t (we will consider $\tau = 0$, 1, 2, 3, and 4, capturing windows of up to five years after the application), $Approved_{it}$ is a dummy that equals 1 if property i was authorized a credit in year t and 0 otherwise, μ_t is a fixed effect for the year t of the application, $\mathbf{X}_b$ is a vector of block b's characteristics measured in 2000, and $\varepsilon_{ib(t+\tau)}$ is the error term. The vector of block characteristics includes the number of housing units, share vacant, share owner-occupied, total population, share female, share black, share under age 18, median age, number of

[15] It is possible that the existence of the NPA may have spurred some investment that would not have otherwise occurred among denied applicants, who were arguably treated by virtue of applying. This would imply that the impact of the program is in fact larger than the difference in permitting between approved and denied applicants would suggest. However, given that only basic descriptions of planned work and estimated costs are required as part of the NPA application (not quotes from contractors) and in light of the very low probability of winning a credit conditional on applying, it is unlikely that the treatment effect of the program on denied properties is large.

[16] An occupancy permit verifies that a building is suitable for occupancy. In St. Louis, occupancy permits are generally not required for residential property. However, a developer may apply for such permits if some portion of the development is commercial or if they plan to receive Section 8 subsidies.

households, number of families, and share in group quarters. The standard errors in this and future regressions are adjusted for heteroskedasticity and clusters at the neighborhood level, which allows for arbitrary correlation in errors within neighborhoods but assumes that errors are independent across neighborhoods.[17]

Note that β_1 captures an intent-to-treat effect given that not all credits that were authorized were claimed. This is arguably the effect of interest from a policy perspective given that it is in the government's power to authorize more credits, but not to compel developers or households to actually use those credits. Nonetheless, we can estimate the effect of the treatment on the treated by simply scaling up the estimate of β_1 based on the fraction of credits actually issued. Given that 77% of authorized credits in the sample were issued, the average treatment effect is on the order of 30% larger in magnitude than the intent-to-treat effects.

Consistent with the means in Table 2, the regression estimates in Panel A of Table 3 suggest that relative to properties whose applications for tax credits were denied, properties whose applications for tax credits were approved were issued about 0.25 additional building permits in the year of their application on average. The difference in building permit issuance to approved and denied projects is significant at the 5% level and, as can be seen in columns (2) and (3) of the table, is highly robust to the inclusion of year dummies and baseline block-level demographic and housing controls. The same is true when we expand the window of time after the year of the application to encompass a two-, three-, four-, and five-year window. Again, with wider windows, there are necessarily more building permits issued in absolute terms to both approved and denied projects. However, the gap in building permit issuance between denied and approved projects persists even with these wider windows. Indeed, we see large and significant increases in the number of building permits issued to approved projects relative to denied projects up through five years. The estimates imply that, relative to the homeowners and developers whose applications were denied, those whose applications were approved were issued nearly two-thirds more building permits during the two-year window they had to complete their projects. When we allow for some additional lag in investment, authorizing a credit boosts permit issuance by a cumulative 0.5 building permits (a 46% increase).

[17] There are 68 neighborhoods represented in the data (11 neighborhoods in St. Louis had no NPA applications between 2003 and 2010). Clustering at the neighborhood level generally produces the most conservative standard errors; the standard errors are qualitatively similar, but tend to be smaller, if they are merely adjusted to be robust to arbitrary heteroskedasticity or if they are clustered at a lower geographic level (such as census block).

Although the windows of time we consider here are relatively short, these results suggest that the credit is not merely shifting planned projects ahead in time. Rather, they appear to be spurring activity that would not have otherwise happened, at least in the near term.[18]

Due to the small sample size and a lack of detailed information about applicants who were denied tax credits (we know their project address, but not how much they requested), we are limited in our ability to test for heterogeneous treatment effects. However, we can provide some suggestive evidence on differences in the impacts of the program depending on the locations of the projects. In Figure 3, we plot the mean difference in permits issued in the year of the application to approved and denied projects for each neighborhood against that neighborhood's population growth between 2000 and 2010. The sizes of the dots are proportional to the number of applications received from that neighborhood. There were smaller differences in permitting between approved and denied applications in neighborhoods with stronger population growth than in neighborhoods with weaker population growth. This suggests that the NPA was more effective in spurring housing investment that would not otherwise take place in declining neighborhoods than in gentrifying ones, a finding consistent with work on other housing programs (Murray 1999, Baum-Snow and Marion 2009, Freedman and McGavock 2015).[19]

4.2 Property Values

Building permit issuance is one measure of housing investment that has the advantage of being easily observed and measured. It also captures the majority of construction and rehabilitation activity that we might expect to have important impacts on housing values. Additionally, using building permit issuance to measure externalities allows us to measure changes in neighbor behavior in response to housing investment; changes in the values of neighboring properties, which are more often used to

[18] As previously discussed, randomization for the NPA is conditional on the year of the lottery, with a potentially different probability of winning each year. While in principle this could lead the pooled sample we consider to being unbalanced on covariates, in practice it does not. Nonetheless, as a robustness test, we separately consider the impact of authorized credits by lottery year. The results are available upon request. Although the smaller sample sizes reduce the statistical significance of the differences when we stratify the sample, the number of permits issued to approved projects exceeds the number issued to denied projects by a wide margin in each year except for 2010. These results suggest that pooling the applications across lottery years, which gives us more power to identify effects of interest, does not jeopardize my ability to exploit the random assignment of credits to applicants to establish unbiased causal impacts.

[19] We also examined whether the effects differed for credits issued during the housing boom relative to the housing bust. However, the reduced-form effects are difficult to compare across periods because take-up of the credits was substantially lower during the recession years.

measure externalities in the housing market, necessarily confound the effects of changes in neighbor behavior and changes in the effects of local amenities on house values.

However, using building permits alone to measure the impacts of the NPA has several drawbacks. It is possible, for example, that tax credit applicants do not apply for permits for some projects. More problematically, applicants' propensity to apply for a permit for a given job may depend on whether they win the lottery; for example, a homeowner might apply for a permit to build a porch on her house if she received a tax credit, but neglect to apply for a permit for the same job if she did not receive the tax credit. Such selection in permit applications would result in upward biased estimates of the impact of the tax credit on construction activity. Further, from a policy perspective, it is important to know whether the construction activity induced by the program is translating into higher home values (and, in turn, property tax revenues), or whether the projects being funded have relatively low returns to credit recipients.

Therefore, we consider the effect of winning a tax credit on the value of the property in question. We first use property assessment data from the City of St. Louis' Assessor's Office, which have a number of advantages. First, the Assessor's Office assessments are intended to reflect market values; they use a number of different methods, including cost, income, and market (i.e., sales comparison) methods, to reach estimates of market values. Second, the office reassesses properties frequently; reassessments occur every odd year unless there is new construction or there are major structural changes (e.g., demolition, new additions, etc.), in which case it is reassessed that year (even if it is even-numbered). Thus, we would expect large projects spurred by the NPA to be reflected in the assessed values. Further, unlike house values based on surveys of households, assessed values are universally available and not subject to biases that might arise if some types of households systematically over- or under-value their houses.[20] The assessment data are also not subject to sample selection problems that arise with sales data.

However, the assessment data have several disadvantages. While reassessments occur at least every other year, they may not immediately or accurately reflect changes to the house that are not large or conspicuous (Pollakowski 1995). Because the assessor in part uses nearby properties as

[20] For example, Kiel and Zabel (1999) find that recent buyers tend to overvalue their houses relative to owners with longer tenures. To the extent that many of the properties receiving NPA tax credits are new construction, this could bias estimates based on survey data. Clapp and Giaccotto (1992) and Gatzlaff and Ling (1994) also highlight how using assessed values mitigates measurement error problems.

comparisons, the assessments also may fail to accurately capture price levels or trends for newer and unusual properties as well as they do for older properties that are more similar to the existing housing stock in a neighborhood. To the extent that the values of proximal properties are used to determine the assessed value of a given property, there is also a sense in which observed spillover effects could be more mechanical than actually related to changes in the quality of the housing stock or nearby amenities. This will tend to bias upward any estimated positive externalities on property values (which we consider in the next section).

With these issues in mind, we compare the values of properties that were approved and denied NPA tax credits in St. Louis. In a regression similar to (1), for the sample of NPA applicants, we regress each property's assessed value measured two years after the application year on a dummy for whether the tax credit was approved. Data from two years post-application should capture changes made to properties seeking credits given both the two-year time limit for completing the proposed project as well as the Assessor's Office re-assessment cycle.

The first panel of Table 4 presents these reduced-form regression results. In the first three columns, we use as the outcome the assessed property value in dollars, while in the second three columns we use the natural log of the property value. The estimates from the models in levels imply that winning a tax credit increases the value of existing properties by \$14,000-\$16,000, which corresponds to a 25%-28% increase relative to the average baseline value. This is slightly smaller than the estimates from the same model in logs, which point to an increase in property values of close to 40%. While none of the estimates from the model in levels is not statistically significant, those from the model in logs are when additional controls are included in the regression.

One concern with using assessed values measured two years after the application date is that we are necessarily comparing values determined during different assessment cycles.[21] To examine the possible influence this might have on the results, we also consider the impacts of winning vs. losing the lottery on assessed values measured in 2013 (3 years after the final lottery year in the sample). As can be seen in the second panel of Table 4, the results are qualitatively and quantitatively similar to those using assessed values 2-years post-application date.

We also collected data from the Assessor's Office on housing transactions. These sales data

[21] A particular concern is that assessments did not rise in lock-step with actual values, and the degree to which they were out of step varied by assessment cycle.

have the limitation of only covering a (potentially unrepresentative) subset of the properties in the data. However, they are free from some of the measurement problems that afflict assessment data. In the third panel of Table 4, we present estimates from linear probability models for whether a property was sold within two or five years on whether that property won an NPA tax credit. We find that properties that are awarded credits are about 11 percentage points more likely to be sold within two years, and nearly 13 percentage points more likely to be sold within five years (the average two-year sale probability in full sample is 0.33, and the average five-year sale probability is 0.38).[22] In the final panel of Table 4, we run the same regressions we used for assessed values, only using sales prices as the outcome (and limiting the sample to the 1,569 properties that transacted within five years of applying for the tax credit). The results for sale prices are qualitatively and quantitatively similar to those for assessed values; in particular, they suggest that winning the tax credit is associated with an increase in property values of approximately one-third. Overall, in line with the results on building permit issuance, the difference in property values across approved and denied applicants suggests that the NPA is having an impact on residential investment, which is in turn affecting property values.

Based on the estimate from the model for assessed value in levels with controls, and given that the average credit authorized is $35,715, every NPA dollar authorized increases recipients' property values by $0.45. Given the average credit issued is $22,153, about $0.72 every dollar in tax revenue actually foregone as a result of the NPA is capitalized directly into the values of credit recipients' homes. Using estimates from the models for assessed values (or sales prices) in logs, the results imply capitalization that is even closer to dollar-for-dollar.

We again estimate the effects by neighborhood in order to tease out potentially heterogeneous treatment effects. The results appear in Figure 4. Consistent with the building permit results, we find that winning a tax credit is associated with a relatively higher probability of sale as well as a larger sale price differential in declining neighborhoods than in growing neighborhoods. Again, this suggests the impact of the program is larger (and conversely, that crowd-out effects are smaller) in declining neighborhoods than in improving ones.

[22]The fraction of properties in the sample that transact is approximately three times the fraction of all St. Louis properties that transact during these intervals. This again reflects selection in the pool of property owners that apply for NPA tax credits.

4.3 Quasi-Experimental Estimates

Much of the previous research on tax incentives to encourage housing construction and rehabilitation has relied on difference-in-differences or other quasi-experimental designs to estimate their impacts. A central concern in these studies is the potential endogeneity associated with the receipt of such tax incentives. To quantify the possible bias associated with such endogeneity, we conducted a series of exercises in which we did not take full advantage of the experimental variation afforded to us by the NPA. Specfically, we isolated attention to those properties that were issued NPA tax credits and estimated treatment effects using several different control groups.

If one only had data on issued credits, comparing building permits issued to credit winners to those issued to all other parcels in St. Louis would yield an estimated impact of the NPA program on construction activity substantially larger than that based on comparing winners to denied applicants. In particular, using the number of building permits issued between 2003 and 2013 as the outcome, comparing credit winners to all other parcels in the cities yields an estimated impact on building permits that is nearly three times as large as that which we get by comparing approved and denied applicants (1.19 vs. 0.41 additional permits). Similarly, using as the outcome the assessed value of properties in 2013, program impacts on property values are about three times as large when comparing credit awardees to all other parcels vs. comparing awardees to denied applicants ($72,251 vs. $21,693). Even if one regression-adjusts or uses propensity score matching to help ensure that properties receiving credits are similar to those in the comparison group, failing to exploit the lottery structure of the program still yields estimated effects of the program that are substantially larger than those derived from the experimental design. Using neighboring parcels (which tend to be very similar in at least age and access to amenities) as controls for those issued credits, we arrive at estimated effects more in line with the experimental results.[23] Specifically, using properties within 100 feet of winning projects as controls, we find that winners are issued 0.47 more permits between 2003 and 2013 (compared to 0.41). Using larger rings, however, the estimated effect is magnified; for example, it grows to 0.56 additional permits when we use as controls all properties within 1000-foot rings of winning applicants. Further, for rings up to 1000 feet, we consistently overestimate the property value effects by at least a factor of two.

[23] As described in Section 5.1, we find evidence of only modest positive spillovers, such that any attenuation of the estimates owing to externalities in this case is small.

5 Spillovers Effects of NPA Tax Credits

5.1 Building Permit Issuance

Winning a tax credit for a particular property might be expected to have two opposing effects on construction activity at nearby properties. On the one hand, by making it cheaper to build in one place relative to another, it might merely shift construction activity in space. If, for example, a developer had two possible sites in mind for new construction but received a tax credit for building at only one of those two sites, the tax credit might have implications for the location of new investment but not the total stock of new housing. This type of crowd out of housing investment has been documented for other major housing programs in the U.S., such as the Low-Income Housing Tax Credit (Eriksen and Rosenthal 2010). On the other hand, new construction activity at one property could induce nearby homeowners to invest more in their properties. Such positive spillovers are often cited as motivation for housing programs that subsidize rehabilitation, and some empirical evidence suggests that households are responsive to their neighbors' investments in housing (Ioannides 2002, Helms 2012).

To test for the existence of spillovers, we first examine whether properties near those that win tax credits are issued fewer or more building permits than properties near those that fail to win tax credits. In doing so, we exclude any neighboring properties that applied for an NPA tax credit; since developers owning contiguous properties often apply for credits for several properties simultaneously, excluding neighboring properties that applied mitigates any concern that any observed effects are driven merely by spatially correlated activity by a single developer as opposed to spillovers between different agents.[24] We would expect negative effects on permit issuance to those properties near winning properties if the tax credit is generally shifting construction activity in space (although this assumes that only proximate properties are substitutes), and positive effects if housing investment at one location typically induces neighbors to invest as well.

In Figure 5, we present average building permit issuance to properties in successive 50 foot rings around those approved and denied NPA tax credits. The data point to relatively more building permit issuance to properties near those that won credits, but the effects are modest. To the extent

[24] For example, a tax credit for one property might make a larger development involving multiple adjoining properties worthwhile. Including adjacent properties that applied for tax credits in the sample increases the magnitude and statistical significance of the estimated spillovers slightly. This suggests that within-developer spillovers are present, but are relatively modest in size.

that there are positive differences, they are also confined to properties within a tight ring around the applicant. In particular, focusing on permit issuance within two years of the application (Panel A), parcels within 50 feet of a parcel whose NPA application was approved apply for a statistically insignificant 0.051 more permits than parcels within 50 feet of a parcel whose NPA application was denied. Those 50-100 feet away from a parcel whose NPA application was approved apply for an imprecisely estimated 0.055 more permits. The gap in permit issuance to properties close to those that were approved credits relative to those that were denied credits falls to 0.005 in the 100-150 foot ring and hovers close to zero out to 500 feet.[25]

The spillover effects are more precisely estimated when the outcome is permit issuance within five years of the application (Panel B of Figure 5). In that case, properties within 100 feet of approved applicants apply for a statistically significant 0.10 more building permits than denied applicants. Note, however, that this effect size is less than one-fifth of the direct effect on winning properties' permit issuance within 5 years. Additionally, the effects dissipate quickly over space; the differential for properties 100-150 feet from approved vs. denied applicants is a statistically insignificant 0.025 permits.

These results suggest that spillovers on nearby households' behavior associated with NPA tax credits tend to be positive on net, inducing neighbors to reinvest themselves more so than merely shifting the location of construction activity. However, those positive externalities are small and attenuate quickly in space. Notably, past papers measuring housing investment spillovers have typically measured them using only house values, which capture changes in the value of the house due to the owner's investment plus changes in the value of the house due to changes in neighboring properties' conditions. The results in this section suggest that actual housing investment in response

[25] To test for spillovers, we also considered the subset of all parcels in the city within 1000 feet of an applicant and ran the following the regression:

$$Permits_{ijb(t+\tau)} = \beta_0 + \beta_1 Approved_{jt} + \beta_2 Distance_{ij} + \beta_3 Approved_{it} \times Distance_{ij} + \mu_t + \mathbf{X}_b\mathbf{\Omega} + \varepsilon_{ijb(t+\tau)}$$

where i denotes the non-applicant property and j denotes the NPA applicant. In this case, $Distance_{ij}$ refers to the distance between property i and applicant j, measured in feet. Therefore, β_3 measures the distance decay in permitting activity among properties close to those that were approved relative to that among properties close to those that were denied tax credits. We also considered variations on equation (2), including specifications with squared and cubed distance terms and discretized bins of distance (the same 50 foot rings depicted in Figure 4). The results of these regressions are available upon request. Consistent with Figure 4, they point to a steep gradient in additional building permit issuance as one moves away from approved applicants' addresses. Only for properties within 100 feet of approved applicants do we see statistically significant increases in building permit issuance.

to neighbors' investment activity is likely to play a role, albeit potentially a minor one, in driving house price changes in the immediately vicinity of a property that receives subsidies.[26]

5.2 Property Values

We now turn to the effects of NPA-subsidized investment on nearby property values. A number of previous papers estimating the spillover effects of subsidized housing investment have found important, and in some cases large and geographically diffuse, external effects on property values. For example, examining new construction and rehabilitations by Community Development Corporations in Cleveland, Ohio, Ding et al. (2000) find that spillovers on local property values are strongest within 150 feet and nearly vanish completely at 500 feet. Others who have looked at typically bigger interventions have found that externalities have larger geographic scope; for example, examining the effects of new subsidized owner-occupied housing in New York City, Schwartz et al. (2006) find impacts on property values that extend up to 2000 feet from a project site. Similarly, looking at the spillovers associated with new public housing in Denver, Santiago et al. (2001) find effects on the prices of homes up to 2000 feet from the site of the investment. Finally, again using property values to measure externalities, Rossi-Hansberg et al. (2010) find that the external effects of housing services fall by half for every 990 feet from a project site.

In Figure 6, we present coefficient estimates from regressions of log city-assessed property values of properties in successive rings around NPA applicants on a dummy for whether the applicant was approved a tax credit. Property values are measured two years after the year of the application. We use the same mutually exclusive rings as in Figure 5. The vertical black lines are 95% confidence intervals, while the vertical red lines are 90% confidence intevals. Standard errors are clustered at the neighborhood level. Two-years after credit authorization, values of properties within 100 feet of those approved credits were about 8% higher in than properties within 100 feet of those denied credits on average. That falls to close to zero for properties between 100 and 500 feet of those approved credits; estimates in that range are not statistically significant. Estimates for sales prices (not shown) are substantially noisier given the sparsity of tranactions in each ring.

[26] In additional tests not shown, we find that the magnitude of spillovers does not differ across neighborhoods that are initially more or less densely populated. This suggests that it is unlikely that the observed spillovers are driven entirely by informational effects, as sharing of information about the program is more likely in neighborhoods that are initially more built up (Hilber 2010).

While we hesitate to put too much weight on these estimates of the return on NPA dollars spent to the government or the community more broadly in light of the limitations of the assessment data, NPA tax credits have meaningful effects on the values of properties that receive them. However, there is some degree of crowd out of private unsubsidized investment. Moreover, investment in housing spurred by the program appears to have externalities that are modest and limited in geographic scope; the values of homes only within 100 feet appear to benefit from housing investment activity spurred by the program.[27] These changes could be in part due to improvements in local amenities related to the subsidized investment; for example, NPA-induced investment may replace blighted properties or vacant lots that may signal neighborhood deterioration and depress nearby property values. Recent research points to an important role for the visual appearance of neighbors in determining house prices (Glaeser et al. 2018). However, as the results in the previous section suggest, the changes in nearby property values are also in part due to changes in neighbor behavior; indeed, we find evidence that at least for very close properties, one neighbor's investment activity (as measured by permit issuance) spurs others to invest as well. Indeed, given the correspondence between building permit issuance and property values among NPA beneficiaries (where an additional 0.5 building permits was associated with a roughly one-third increase in property values on average over five years), the increase in building permit issuance observed among neighboring properties can explain at least two-thirds of the observed increases in property values among those properties. In other words, beyond its direct impact on recipient properties, the NPA may affect communities through its effects on local amenities as well as through its effects on neighbor behavior.

6 Conclusion

The merits of subsidizing investment in housing construction and rehabilitation in low-income neighborhoods have long been debated. Proponents of tax incentives to encourage such residential investment highlight their potential to revitalize struggling communities in which private incentives

[27] We are limited in our ability to conduct a complete cost-benefit analysis given that the property value data do not cover all properties that were approved or denied tax credits. Moreover, we are focusing only on the subset of applicants in St. Louis; the program is statewide, and judging the overall benefits of the program relative to its costs would require statewide data on property values. We are hoping to use Zillow data for this purpose in the future.

to invest may be lacking but the social benefits of doing so could be large. However, whether subsidies under such programs merely crowd out private unsubsidized investment or have any persistent effects remains unclear.

In this paper, we take advantage of the lottery structure of Missouri's Neighborhood Preservation Act (NPA) to examine the effects of tax incentives for housing investment in low-income areas. Missouri's NPA offers tax credits to homeowners and developers that improve or expand the owner-occupied housing stock in the state's poorer communities. Due to limits on the amount that can be awarded, the state uses a lottery to determine which applicants receive credits. Exploiting the random assignment of NPA tax credits and using detailed property-level data from the City of St. Louis, we find evidence of incomplete crowd out of unsubsidized housing investment. While there appear to be some positive spillovers on neighbors' investment behavior, the effects are modest in magnitude and confined to properties within 100 feet of those receiving credits. Impacts on property values are similarly small and limited in geographic scope. The results suggest that while neighbor interactions and amenity effects could be important in understanding local housing markets, they are unlikely to amplify the positive effects of tax incentives like the NPA sufficiently to induce broader neighborhood change.

This paper contributes not only to the literature on the impacts of subsidies for residential investment and on housing externalities, but also to a growing body of research on government incentives aimed at improving economic and social conditions in low-income neighborhoods. Evidence on the efficacy of place-based incentives is mixed at best (Glaeser and Gottlieb 2008, Neumark and Simpson 2015). While the results in this paper are to some extent specific to the institutional features and context of Missouri's NPA, they suggest that the types of tax incentives for home construction and rehabilitation used across the U.S. and in other countries can have measurable effects on targeted communities. However, given the degree of crowd out and the limited scope of positive spillovers, the results indicate that housing production subsidies, at least of the nature offered under the NPA, are unlikely to spur major transformations in low-income communities on their own.

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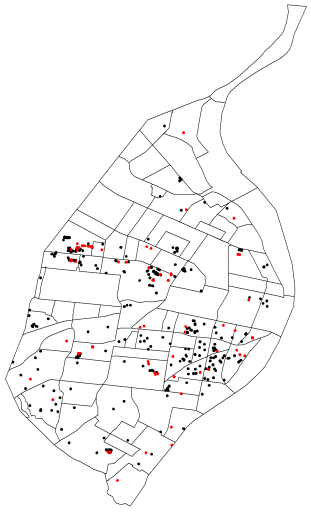
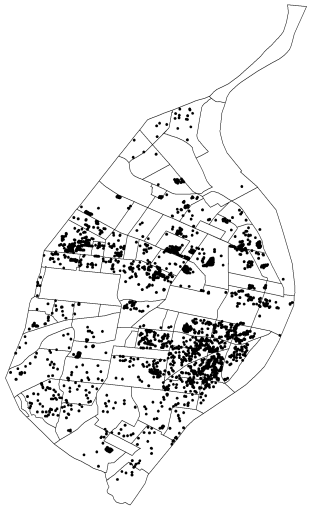
Figure 1. Locations of Approved and Denied NPA Projects in the City of St. Louis, Missouri

(a) Approved Projects



(b) Denied Projects



Note: Points represent projects for 2003-2010. Red points in (a) are approved but incomplete projects. Boundaries represent the 79 neighborhoods of the City of St. Louis.

Figure 2. Mean Number of Building Permits for Approved and Denied Applications for Different Timeframes

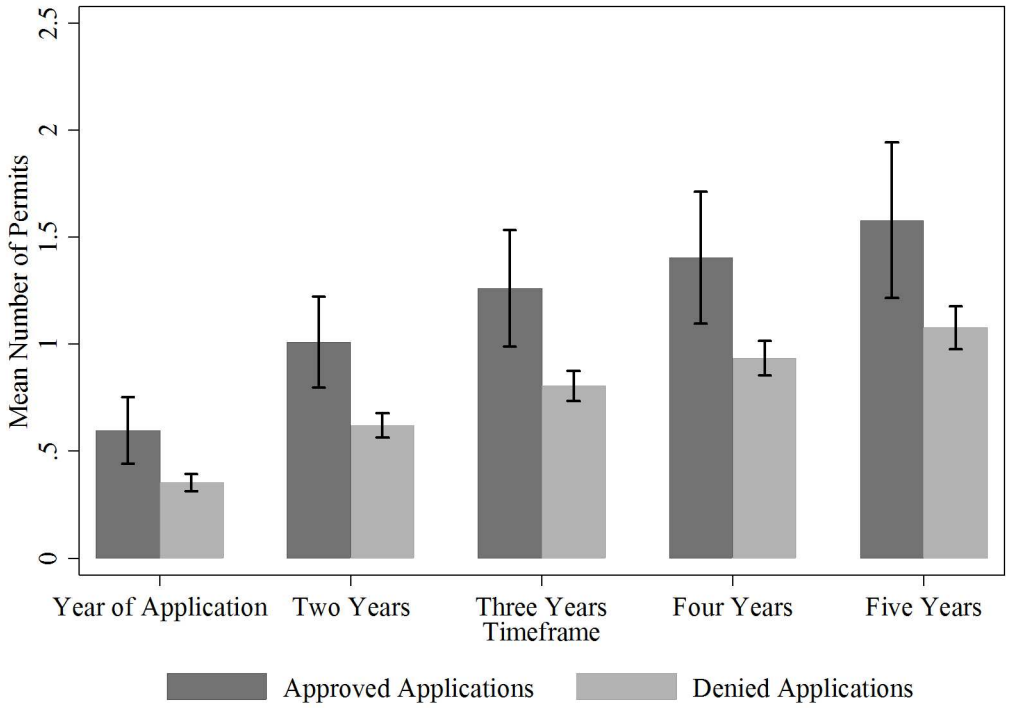
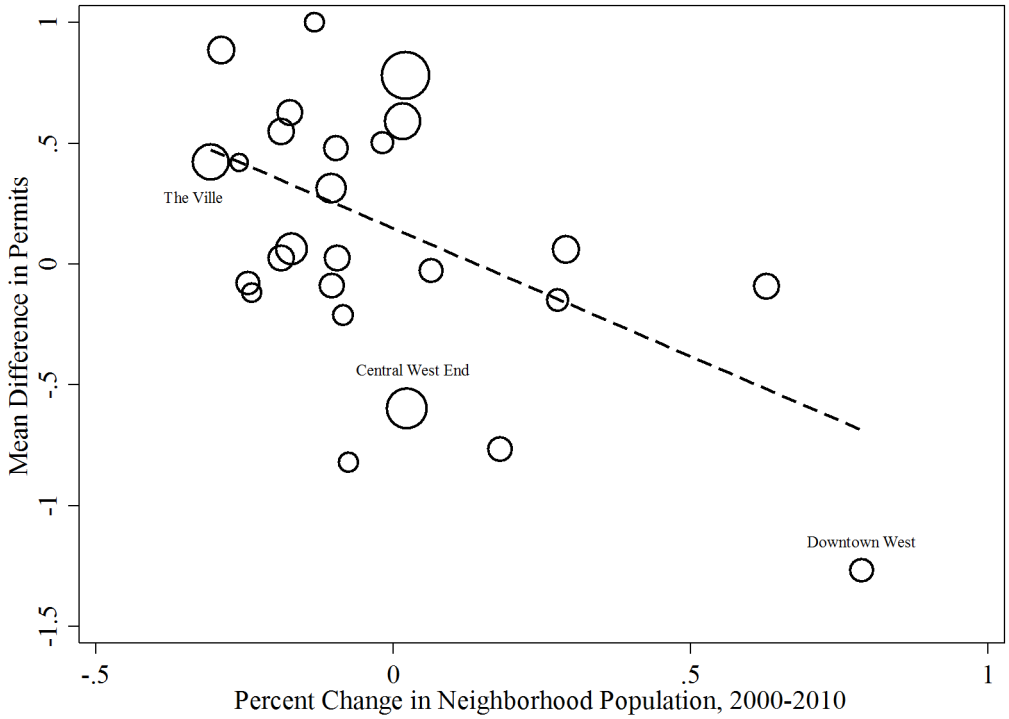
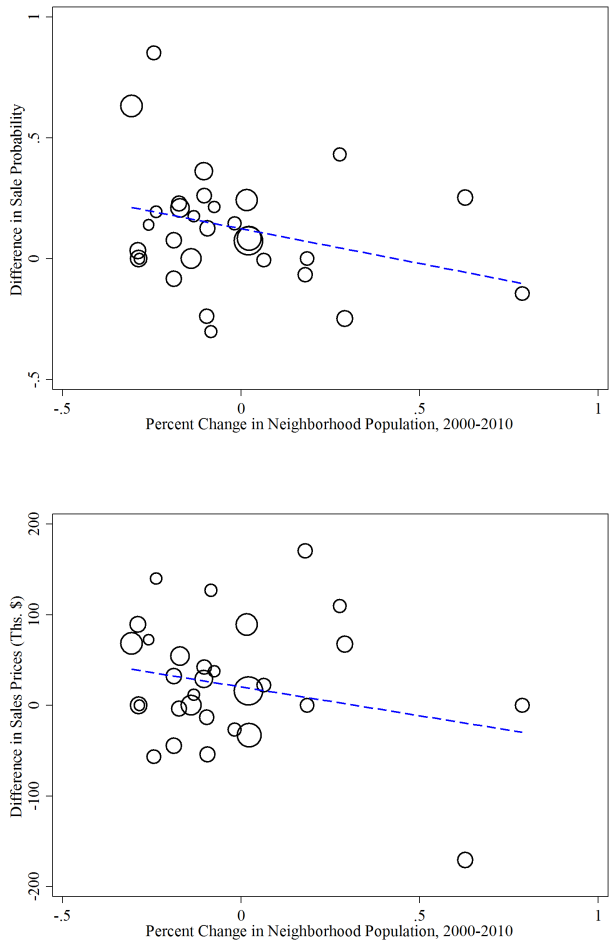


Figure 3. Mean Difference in Permits for Approved and Denied Application by Neighborhood



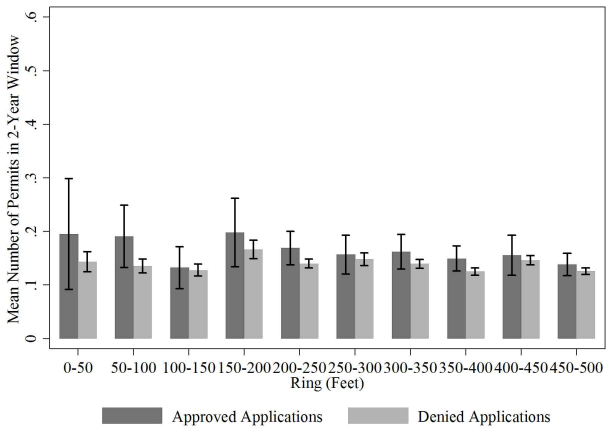
Notes: Includes neighborhoods with at least 50 applicants between 2003 and 2010.

Figure 4. Differences in Sale Probabilities and Sale Prices for Approved and Denied Applications by Neighborhood



Notes: Includes neighborhoods with at least 50 applicants between 2003 and 2010.

Figure 5. Mean Building Permit Issurance to Properties in Rings around Approved and Denied Applicants, Two- and Five-Year Windows



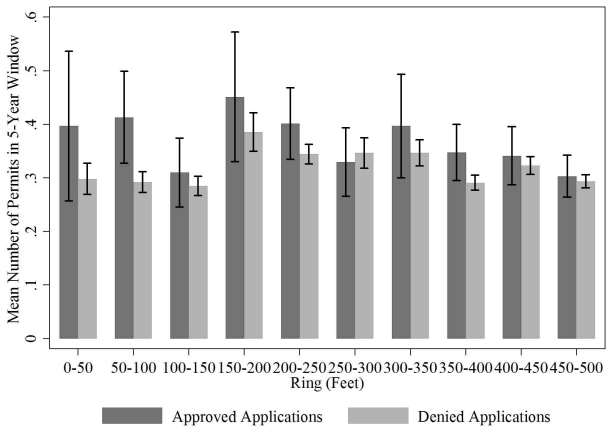


Figure 6. Difference in Log Property Values for Properties in Rings around Approved and Denied Applicants

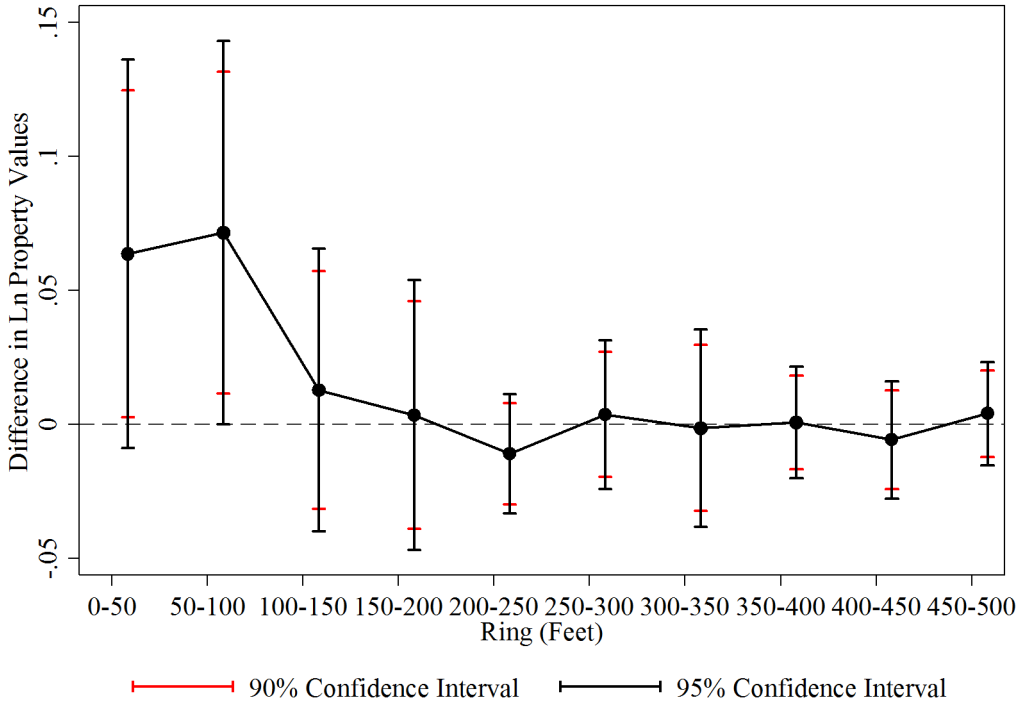


Table 1. Descriptive Statistics on Denied and Approved Applicants

	(1)	(2)	(3)
	Denied	Approved	Difference (2)-(1)
A. Census Block Characteristics, 2000			
Housing Units	44.13	47.16	3.035
Share Vacant	0.23	0.22	-0.016
Share Owner-Occupied	0.43	0.46	0.032*
Population	82.97	88.94	5.971
Share Female	0.50	0.50	-0.001
Share Black	0.64	0.64	-0.002
Share Under 18	0.27	0.27	-0.0003
Median Age	31.76	32.16	0.397
Number of Households	33.93	37.10	3.164
Number of Families	17.63	19.13	1.498
Share in Group Quarters	0.02	0.01	-0.005
B. Property Values ($), 2002			
Mean Appraised Market Value ($)	58,654	54,694	-3,960
Mean Sales Price ($)†	90,598	81,244	-9,354
C. NPA Tax Credits, 2003-2010			
Mean NPA Credit Authorized ($)	0	35,715	
Median NPA Credit Authorized ($)	0	33,210	
Fraction Claimed	0	0.77	
Mean NPA Credit Issued ($)	0	22,153	
Median NPA Credit Issued ($)	0	20,665	
Number of Projects	3860	286	

Note: Includes applications submitted in St. Louis between fiscal 2003 and 2010. † Includes only properties that transacted in 2002 (229 properties). Difference significant at the *10%, **5%, and ***1% level.

Table 2. Permits for Properties with Denied, Approved, and Completed Projects

	(1)	(2)	(3)	(4)	(5)
	All	Denied	Approved	Completed	Difference (3)-(2)
A. Building Permits					
Year of Application	0.37	0.35	0.60	0.72	0.245***
Two-Year Window	0.65	0.62	1.01	1.24	0.390***
Three-Year Window	0.84	0.81	1.26	1.53	0.456***
Four-Year Window	0.97	0.93	1.41	1.70	0.471***
Five-Year Window	1.11	1.08	1.58	1.87	0.503***
B. Other Permits (Two-Year Window)					
Demolition Permits	0.04	0.04	0.04	0.05	0.004
Occupancy Permits	0.49	0.47	0.73	0.93	0.263*
Electrical Permits†	1.26	1.24	1.53	1.96	0.291
Mechanical Permits†	0.05	0.05	0.03	0.05	-0.008
Plumbing Permits†	0.79	0.77	1.06	1.34	0.289
Permit Waivers†	0.02	0.02	0.01	0.01	-0.011
Number of Projects	4146	3860	286	221	

Note: Includes 4146 NPA applications submitted between 2003 and 2010. † Data only for 2003-2008. Statistically significant at the * 10% level, ** 5% level, and *** 1% level.

Table 3. Building Permits Regression Estimates

	(1)	(2)	(3)
	One-Year Window		
Approved	0.245**	0.266**	0.270**
	(0.1026)	(0.104)	(0.111)
	Two-Year Window		
Approved	0.390***	0.402***	0.413***
	(0.100)	(0.105)	(0.111)
	Three-Year Window		
Approved	0.456***	0.459***	0.472***
	(0.112)	(0.123)	(0.125)
	Four-Year Window		
Approved	0.471***	0.466***	0.482***
	(0.124)	(0.138)	(0.142)
	Five-Year Window		
Approved	0.503***	0.494***	0.515***
	(0.142)	(0.154)	(0.148)
Lottery Year Dummies		Y	Y
Demographic and Housing Controls			Y
Number of Projects		4,146	

Note: Includes 4146 NPA applications submitted between 2003 and 2010. Demographic and housing controls include the variables listed in Panel A of Table 1. Standard errors in brackets are adjusted for heteroskedasticity and clusters at the neighborhood level. Statistically significant at the * 10% level, ** 5% level, and *** 1% level.

Table 4. Property Values and Sales Regression Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	Assessed Property Value after 2 Years ($)			Ln Assessed Property Value after 2 Years		
Approved	15,873	14,111	16,039	0.323	0.432*	0.380**
	(26,878)	(28,282)	(24,356)	(0.227)	(0.225)	(0.153)
	Assessed Property Value, 2013 ($)			Ln Assessed Property Value, 2013		
Approved	21,692	18,871	24,891	0.422*	0.492*	0.459***
	(23,193)	(22,963)	(21,694)	(0.245)	(0.250)	(0.162)
	Sale within 2 Years			Sale within 5 Years		
Approved	0.111***	0.123***	0.112***	0.131***	0.140***	0.127***
	(0.041)	(0.041)	(0.039)	(0.043)	(0.043)	(0.0430)
	Sale Price ($)			Ln Sale Price		
Approved	12,921	14,754	29,830**	0.374*	0.337*	0.363*
	(21562)	(17964)	(12259)	(0.194)	(0.193)	(0.188)
Lottery Year Dummies		Y	Y		Y	Y
Demographic and Housing Controls			Y			Y

Note: Includes 4146 NPA applications submitted between 2003 and 2010. Data in final panel includes 1569 projects that were sold within 5 years of receiving an NPA credit. Demographic and housing controls include the variables listed in Panel A of Table 1. Standard errors in brackets are adjusted for heteroskedasticity and clusters at the neighborhood level. Statistically significant at the * 10% level, ** 5% level, and *** 1% level.

Appendix

Table A1. Eligible and Ineligible Expenditures under Missouri's Neighborhood Preservation Act

Eligible Expenditures	
New Construction	Rehabilitation
Property acquisition	Site preparation
Development	Surveys
Site preparation	Architectural and engineering services
Surveys	Construction
Architectural and engineering services	Modification
Construction	Expansion
Utility extensions on the property (water, sewer, electrical)	Remodeling
Sidewalks and driveways directly attached to the building	Structural alteration
	Replacements and alterations
	Costs directly attributed to the rehabilitation
	Utility extensions on the property (water, sewer, electrical)
	Sidewalks and driveways directly attached to the building
Ineligible Expenditures (Not Exhaustive)	
Costs not directly attached to the building	
Landscaping, including privacy fencing	
Buildings other than garages	
Appliances	
Mirrors	
Awnings	
Marketing	
Parking lots	
Window treatments	
Items that are removable without damage to the property	

Source: Missouri Department of Economic Development.
http://www.ded.mo.gov/BCS%20Programs/BCSProgramDetails.aspx?BCSProgramID=68