Investment Externalities in the Housing Market:
Evidence from Historical Rehabilitative Tax Credits

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Abstract

Previous research has found that local amenities and neighborhood attributes can substantially impact the surrounding housing market. The external impact is often a key Pigouvian rational for federal and state tax policy subsidizing investment in rehabilitating historical properties via rehabilitative tax credits (RTC). This study examines the empirical question of whether property investment or rehabilitation has spillover effects on nearby properties utilizing a unique data set of properties salvaged through the use of RTCs in Virginia. Using over a decade of data from a regional MLS, the results indicate that homes in close proximity to RTC properties sell for a premium, but only limited evidence of small liquidity effects. We find a strong, pronounced price externality effect for homes outside historic districts, and incidentally, little (if any) externality from additional RTCs within historic districts.

Keywords: tax credits, residential real estate, historical, residential investment, home prices, investment decisions, externalities, home liquidity

JEL Codes: R38, H23, D62

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1. Introduction

A basic tenet of economics, dating back at least since Pigou (1920), is that externalities can misprice incentives, where private benefits and costs may not necessarily align with broader social optimum. The textbook examples of negative externalities (e.g. industrial pollution) and positive externalities (e.g. beekeepers and pollination) illustrate the idea that private incentives may induce too much activity (for negative externalities) or too little (for positive externalities), which often serve as rationales for taxes and subsidies to curtail or encourage various economic activity. In the housing market, one of the more prominent examples of Pigouvian policy is the widespread adoption of historic rehabilitative tax credits (RTC), where federal and state governments subsidize residential investment in rehabilitating qualifying properties via tax credits. The preservation and renovation of historic properties have numerous potential externality effects, including beautifying historic neighborhoods that have fallen into disrepair over time, preserving and restoring historical landmarks, promoting tourism and educational opportunities. Given that home prices generally capitalize location amenity values, a key empirical question is whether housing market prices and liquidity reflect these potential spillover effects. Hence, the primary purpose of this paper is to examine this historic property externality empirically, analyzing the extent to which a housing market capitalizes these effects in nearby home prices and liquidity. A broader contribution of this paper is to utilize unique microdata in the housing market to shed light on the extent to which private investment has spillover effects and their subsequent implications for valuation.

In this study, we examine a key housing market in Virginia, which covers Richmond and the surrounding areas, which is an important setting given that the Commonwealth of Virginia has been one of the most active states in historic preservation and use of rehabilitative tax credits for the past two decades. As of 2012, Virginia ranked third in the United States, only behind Massachusetts and Missouri, in terms of total dollar volume for the use of rehabilitative expenditures. Since the inception of the Virginia's Historic Rehabilitative Tax Credit (RTC) Program in 1997 through 2013, the program has spurred private investment of almost $3 billion in a total of 2,375 historic rehabilitative projects. The majority of tax credit usage has occurred more often in urban areas than rural areas. Of the 2,375 tax credit projects, 1,185 such projects were in Richmond, Virginia alone. The total economic impact in Virginia as a result of the historical rehabilitative tax credit spending has been previously estimated to be $3.93 billion, with RTC projects generating and estimated labor demand of more than 31,000 jobs over the period (DHR, 2014).

The Department of Historic Resources in Virginia administers both the state and federal rehabilitative tax credits. Both programs, state and federal, allow individuals to invest their income taxes owed to the government in RTC projects as equity financing. The amount of the tax credits are based on total rehabilitation costs. Under the federal program, up to 20% of allowable rehabilitation costs qualify for tax credits and under the Virginia state program 25% of the allowable costs qualify. Such historical rehabilitative tax credits (RTC) are available for owner-occupied and income-producing properties and are dollar-for-dollar reduction in tax liability. While there have been a number of broader assessments of economic impact of rehabilitation tax credits from various policy papers and state/local economic impact studies, the academic literature has not yet examined the externality effect of individual rehabilitative investment on individual home prices and liquidity at a very fine-grained micro-level, which is an important question for understanding pricing dynamics and the microstructure of the housing market specifically, and the nature of investment impacts more generally. Overall, we find consistent evidence of a robust price externality effect from RTC projects, and more limited evidence of RTC projects having much impact on the liquidity of nearby homes.

2. Background and Related Literature

Historic designation can exert various beneficial effects on property value, which make it in the homeowner's interest to pursue this designation (analogous to the beekeeper's private incentive to harvest honey, independent of its other social benefits). First, historic status accords prestige from the official recognition that a building or area has special qualities. This prestige is recognized by the real estate market, as real estate agents often stress this amenity value in selling a historic property. Second, designation adds a protective overlay to a historic property or area. Disruptive demolition from highway construction, urban renewal, and other government-aided projects becomes less of a threat for these properties. Also, exterior work to a historic property is reviewed as to its compatibility. Likewise, new construction on vacant lots in the historic district or nearby area may also be regulated for scale and appearance. Third, federal tax credits and other financial measures are often accorded to historic properties. Beyond the private incentive for valuing historic designation, sometimes as a result of a historic property's prestige, protective, and incentives features, designation often instills further interrelated positive externalities for the broader neighborhood. These may include fostering special institutional financing, encouraging property rehabilitation, strengthening an area's retail health and tourist trade, and catalyzing formation of community organizations and activity[1].

Property value or the desire to live in this niche type of housing may be dampened, however, because of certain designation consequences. For example, following designation,

[1] Advisory Council on Historic Preservation, The Contribution of Historic Preservation to Urban Revitalization (Washington, D.C.: U.S. Government Printing Office, 1979).

alteration or demolition of the property accorded historic status must be approved by a local landmarks commission or committee. Historic property owners can incur additional expenses as a result of these regulatory requirements, both directly in the form of outlays for professional assistance, and indirectly from the delays attendant to such administrative procedures. Similarly, historic designation may impede the realization of a designated property's "highest best use." The degree to which the varying effects noted above are exerted in any given situation, is theoretically ambiguous and an empirical question that has merited some attention in the literature.

A fair amount of empirical work has been done in the area of historical properties and their relationship to residential real estate, yet most of it has focused on the *district* designation itself, and not so much focus on individual, localized externalities. Coffin (1989) provides one such early example. Using data from two cities in the western Chicago suburbs, Coffin estimates that the creation of historic districts in these two cities caused housing prices to increase in the district by approximately 6-7%. This result was statistically significant in only one of the two cities. However, it was significant in the city that had restrictions on land use incorporated into the district, suggesting that buyers were willing to pay a premium in the historic district providing that there was some restrictions placed on possible redevelopment of the district. Using a similar approach, Ford (1989) demonstrates that historic districts have a positive and significant impact on housing prices using data from Baltimore, Maryland. Ford (1989) finds that houses located in areas with a historic district designation will sell at a premium over similar properties in non-historical designated districts due largely to the fact that homebuyers are willing to pay a premium for the assurance that their neighborhood will remain static over time.

Furthermore, the type of designation, whether federal, state or local, tends to have some impact on housing values. Asabere and Huffman (1991) and Asabere and Huffman (1994) both provide further evidence that location in federally certified historic districts have positive and significant impacts on the value of single-family homes within this designated area. A 1991 study by Schaeffer and Millerick found that national designation positively impacts property values, while local designation negatively impacts property values. The authors attribute the difference to the more stringent controls in the local area and the enhanced prestige associated with being part of a national district. Similarly, Leichenko et al. (2001) use a sample of nine cities in Texas to further test the effects of historic preservation districts. Their results suggest that the average property value is increased from 5 to 20 percent within historic districts. This percent change is related to the restrictiveness of the designation; the less restrictive the designation, the greater positive impact on property values.

Using classic cost-benefit analysis, Lahr et al. (2003) study the effect of historic preservation in Memphis, Tennessee. The authors find that not only are property values on average $7,500 higher in historically designated neighborhoods but also appreciation in housing values over the period 1998 to 2002 was almost 10 percent higher in the historic districts. In addition to the economic impact of heritage tourism, the authors also estimate the value of historic restoration. They find that historic preservation in Shelby County supports 1200 jobs, $26 million in taxes and $54 million in income annually. Additional scholarly research has focused on the national impact of federal rehabilitation tax credits using the Preservation Economic Impact Model (an input–output model) to assess construction-stage direct and multiplier effects of rehabilitation tax credits on jobs, income, wealth, output, and tax revenues

(Listokin et al. 2011; Listokin, Lahr, and Heydt 2012)[2]. The researchers find that the program has had a positive cost–benefit outcome of US $4.8 billion over its lifetime.

Relaying on the Mills Act as the historic designation mechanism, Narwold et al. (2008) finds that houses with a Mills Act contract receive a 16% premium over similar houses in the same neighborhood[3]. The size of this premium seems to exceed the capitalized value of the tax benefit available under the Mills Act and suggests that either there is a quality difference in these houses not captured by the structure specific characteristics, or homebuyers are willing to pay a significant premium for a historically designated house.

Others have also suggested that historic neighborhoods are often better maintained and, as a result, non-historic properties that border these historical districts tend to have higher property values (Coulson and Lahr 2005, Leichenko, Coulson and Listokin 2001). In addition, historic districts provide an incentive to surrounding property owners to invest and improve their homes, and benefit from the design restrictions placed on historic properties (Ford 1989, Leichenko, Coulson & Listokin 2001). Other studies find no proximity effect for non-historical homes. For example, a study of property values of homes surrounding historical districts in Baton Rouge, Louisiana, found no increase in property values of homes adjacent to historical districts. The homes surrounding historical districts in Baton Rouge, Louisiana, did experience faster sales times as a result of the historic district positive externality (Zahirovic-Herbert and Gibler 2012).

[2] Also see HTTC (Historic Tax Credit Coalition). 2010. First Annual Report on the Economic Impact of the Federal Historic Tax Credit. Washington, DC: The Historic Tax Credit Coalition.

[3] The Mills Act allows for individual houses to be designated as historically significant. Under the Mills Act, property taxes are lowered on the historically designated properties, costing local governments tax revenues.

While the empirical literature on historical properties has focused on the value of a historic district, there has been far more limited attention to the external value of individual properties. To date, the only attempt, to our knowledge, is Coulson and Leichenko (2001), where they examine the effect of individual house historical designation on surrounding properties within the same census tract. The City of Abilene, Texas offered homeowners a choice of two different types of tax breaks in exchange for historical designation. The homeowner were able to choose to have their property taxes reduced by either $200 or 20% (whichever is greater) or a project-based tax break based on approved improvements to the property. To examine the externality effect of historic designation, the authors simply count the number of historically significant houses within the census tract in which the subject property is located. Their results suggest that the value of a house increases by 0.14% for each additional historical house within the census tract.

The empirical approach taken by Coulson and Leichenko (2001) has a number of methodological deficiencies, which cast doubt whether the statistical relationship they find is properly identified as causal. First, the simple count measure of the number of historical houses by census tract may actually be capturing some other census tract specific characteristic or some confounding factor that can be reflecting higher house prices (e.g. higher wealth, which may not be accounted for by their median income control). That is, home prices may have been higher in census tracts prior to the historic designations of properties within it for some other reason, and without any sort of pre/post analysis, causality becomes a serious concern for cross-sectional analysis of this nature. Coulson and Leichenko (2001) go on to provide a cost-benefit calculation in their study to evaluate the extent of the positive externality, but if the cross-sectional estimates are reflecting some other unobserved heterogeneity, this cost-benefit analysis may not accurately assess the net benefits of the externality. Furthermore, there is reason to believe that value of having a historical house in the neighborhood will be a declining function of distance even within a census tract, requiring a finer grain analysis of the externality effect. Finally, the externality effect may vary by the extent of the rehabilitation of the historical property, and more crude count measures may not capture this variation. We address these concerns, among others, with our methodological approach that we describe in section five, pursuing an empirical strategy that provides reasonable evidence that our results are properly identified as causal.

3. **Theoretical Model**

This paper offers a simple search-based model of how historical properties influence the price and liquidity of surrounding of surrounding non-historical properties. Proximity to historical properties may have two offsetting effects on buyers' willingness-to-pay. First, there may be a neighborhood historical value, cache, or cosmetic effect arising from the nearby historical property. At the same time, however, the historical property may generate negative neighborhood externalities. It may be poorly maintained, exhibit idiosyncratic architecture that does not complement or improve the neighborhood, or it may generate greater noise and traffic if it attracts tourists or sightseers. Taking these possible effects into account, we can denote the willingness-to-pay of buyer type s for house with characteristics vector $\mathbf{x}$ as

$$b = w(\mathbf{x},s) + h(t) - e(t)$$

where $h(t) \geq 0$ is the historical value effect and $e(t) \geq 0$ the possible negative externality effect at distance t from the historical site. We expect that both the historical value effect and negative externality weakly decline with distance from the historical property, $h' \leq 0$ and $e' \leq 0$, although they likely will not decline at the same rate. Buyer types are distributed following $B(s)$.

It is sufficient to consider the simplest search model with no time discounting and a stationary distribution of buyer types. Consider the seller of a particular house with characteristics **x.** The seller's optimal search strategy is to set the reservation price r to maximize the expected selling price less search cost, $E[P - Tc]$, where T is time on the market and c is the search cost or holding cost per period on the market. The reservation price establishes the seller's stopping rule: sell to the first buyer who arrives offering at least the reservation price. Lippman and McCall (1978) show that the seller's optimal reservation price satisfies the marginal waiting time condition

$$E[b - r \mid b \geq r] = c$$

This is the familiar condition that the optimal reservation price equates the marginal cost of turning down a current offer, the waiting or search cost (the right hand side), with the marginal benefit, the expected gain from an offer possibly forthcoming in the next period (the left hand side).

For this application the reservation price condition becomes

$$v(h\text{-}e)\int_{b\geq r}(b - r)dB(s) = c$$

where the probability of a visit by a potential buyer at a given time is v, which may depend upon the attractiveness of the surrounding neighborhood, that is, historical value effect and the possible negative externality effect, $v' \geq 0$. The seller's optimal reservation price is the implicit solution to this condition, $r(\mathbf{x},c,t)$. Implicit differentiation yields the standard search cost result, that greater seller search or holding costs prompt the seller to reduce the reservation price,

$$\partial r/\partial c = -1/\, v\int_{b\geq r}dB(s) < 0$$

What is new is that the reservation price varies with distance from the historical property; implicit differentiation yields

$$\partial r/\partial t = [h' - e'][\, v' \int_{b\geq r}(b - r)dB(s) + v\int_{b\geq r}dB(s)] \,/\, v\int_{b\geq r}dB(s)$$

The sign of this result follows the sign of $h' - e'$; the probability of buyer arrival decreases or increases with distance from the historical site as $h' > e'$ and $h' < e'$, respectively.

What do these relationships imply about selling price and liquidity? Looking first at liquidity, the probability of the house selling at a particular time, given it has not sold previously, is

$$q = v(h+e)\int_{b\geq r}dB(s)$$

Substituting the optimal reservation price into this equation and differentiating yields

$$\partial q/\partial t = v'[h'-e'] \int_{b\geq r}dB(s) + v'[h'-e']\, B'(b^u) - v(\partial r/\partial t)B'(r)$$

Since the expected time on market is proportional to the inverse of q, the above result establishes that time on the market may rise or fall with greater distance from the historical site, regardless of the change in the historical value and externality with distance.

Turning to the expected selling price, note that the expected price of a house that sells is

$$E[P] = v\int_{b\geq r}bdB(s)/\int_{b\leq r}dB(s)$$

Substituting the optimal reservation price into the expected selling price and differentiating yields the relationship between selling price and distance from the historical site as

$$\partial E[P]/\partial t = \{\, v'\int_{b\geq r}bdB(s)/\int_{b\leq r}dB(s) + v'v\int_{b\geq r}dB(s)/\int_{b\leq r}dB(s)$$

$$+ [vb^u B'(b^u)\int_{b\leq r}dB(s)+vB'(b_l)\int_{b\geq r}bdB]/(\int_{b\leq r}dB(s))^2 \,\}(h'-e')$$

The expression in brackets is positive so that the sign of $\partial E[P]/\partial t$ follows that of the expression $h'-e'$. The expected selling price increases (decreases) with distance from the historical site as the historical value effect declines more slowly (rapidly) with distance than does the negative externality effect.

Finally, define $\Delta = h - e$. Substituting into the expected selling price expression and differentiating *at a given distance t* we find

$$\partial E[P]/\partial\Delta = v'\int_{b\geq r} b dB(s)/\int_{b\leq r} dB(s) + v'v\int_{b\geq r} dB(s)/\int_{b\leq r} dB(s)$$

$$+ [vb^u B'(b^u)\int_{b\leq r} dB(s) + vB'(b_l)\int_{b\geq r} b dB]/(\int_{b\leq r} dB(s))^2 > 0$$

This implies that selling prices are higher (lower) at locations where $\Delta = h - e > 0$ ($\Delta = h - e < 0$), that is, where the historical value effect exceeds the negative externality effect. The RTC covers expenditures to refurbish historical properties, which, if successful, reduce one of the more noteworthy negative externality effect, i.e. disrepair or severe depreciation that comes with age. In terms of the theory, the RTC, if successful, increases Δ at locations for which $e > 0$. Thus, the model also predicts that RTC expenditures increase selling prices at locations affected by the negative externality. As the negative externality diminishes with distance from the historical site, therefore so will the RTC effect on selling prices.

Finally, following earlier analysis, we can show that the effects of Δ or RTC on expected time on the market are ambiguous. Therefore, while the effects on price are clear, the liquidity effects remain an empirical question.

4. **Data**

The data utilized in this study comes from central Virginia MLS system with the initial data set being comprised of over 222,000 residential properties. The data used in this analysis covers residential properties listed with a real estate agent and displayed for sale in the Richmond Virginia MLS, covering the Greater Richmond Area. The sample covers residences listed for sale over the just under 13-year period April 1998 through February 2011. After culling for incomplete, illogical and missing data, the final data set consists of 198,624 properties which were listed for sale of which 112,349 were successful transactions.[4] Since MLS data are entered by the listing agent or office staff, we compare random samples of the MLS data with property tax records as an additional check for accuracy. The sampled MLS data are in full agreement with property tax records.

The data consists of typical physical property characteristics such as property age, square footage, various amenities including garage or fireplace, geographical information, economic controls (i.e., mortgage rates) and listing and selling price. A complete list of variables are provided in Table 1 along with their descriptive statistics. The Greater Richmond Area consists of a mix of urban, suburban, and rural areas that is typical of a medium-sized housing market in the U.S., with an average 3.57 number of bedrooms, 2.04 bathrooms, and 2,081 square feet. Figures 1 through 5 in the Appendix illustrate some of the geography of our Richmond data and some examples of rehabilitated historical properties near MLS listings.

Panel A of Table I also shows that of the listed 112,349 properties that were sold, 2% were located within 0.10 miles of an RTC property, 4% were located with 0.25 miles, and 6% were located within 0.5 miles of an RTC property. However, 1% of properties sold within our MLS were located within an historic district. Panel B reports the summary statistics of our primary variables of interest, which we discuss in more detail in the next section. Conditional on being near (i.e. 0.1 miles) a RTC property, the average cost of an RTC project located within 0.10 miles of a listed property is $337,231 (not tabulated), which is very similar to the median

[4] We culled outliers consistent with our studies, confining our data to a more "typical" range of homes. We culled the top and bottom 5% of sale price (corresponding to homes selling below $50,000 and above $1,000,000) and the top 1% of time on market. We also culled homes with more than 10,000 sq. ft., 10 bathrooms, 40 acres, and 6 levels. Generally, the findings of this study are not sensitive to dropping these observations or particular cutoffs.

amount of RTC expenditures within 0.1 miles within the year prior to a home being listed ($332,293). Indeed, the mean cost total cost of all RTC projects located within 0.10 miles within a year prior to a home being listed is $853,719. For ease of interpretation, we divide these figures by $100,000 such that a one unit change in our analysis in Section 6.

5. Empirical Methodology

5.A. Methodology Overview

The principal objective of this study is to determine whether close proximity to RTC properties or the amount spent on said RTC properties has a significant external impact on nearby properties listed for sale. Within the pricing and duration (time on market) real estate literature, there are opposing views as to which hedonic methodology is the most appropriate when answering this type of empirical question. Numerous previous studies utilize a simple OLS methodology for pricing models (e.g. Rutherford, Springer and Yavas, 2005; Levitt and Syverson, 2008) as well as time on market models (e.g. Belkin, Hempel and McLeavey, 1976; Levitt and Syverson, 2008). Another approach that has gained increased attention in the pricing and duration literature is to estimate price and liquidity simultaneously, as it does not treat price and liquidity as independent outcomes, but rather models them as a joint system of equations. Some examples of simultaneous systems (2SLS and 3SLS) include Sirmans, Turnbull and Benjamin, (1991), Knight (2002), Turnbull and Dombrow (2006, 2007), Clauretie and Daneshvary (2008), and Waller, Brastow and Johnson (2010), Bian, Turnbull, Waller and Wentland (2014).[5]

[5] However, there is evidence that OLS may be problematic for liquidity modeling (Lancaster, 1990) and as a result some researchers have chosen to use a hazard modeling approach to analyze duration (e.g. Anglin, Rutherford and Springer, 2003; Rutherford Springer and Yavas, 2005; Waller, Brastow and Johnson, 2010; Rutherford and Yavas, 2012). We show the results of a series of duration models in Appendix Table B.

This study employs both approaches (OLS and 3SLS) in order to provide estimates that are methodologically comparable to previous studies and to assess the robustness of the empirical results across methodologies. The OLS pricing model and the 3SLS simultaneous price-liquidity model broadly follow the same general hedonic framework, with specific differences in empirical specifications noted below. That is, both approaches control for relevant property, location, and time characteristics to isolate the effect of RTC properties on nearby properties. In addition, both methodologies incorporate a variation of a difference-in-difference (diff-in-diff) analysis, where we contrast the effect of "treated" properties (where a home was listed *after* a nearby rehabilitation was completed) with the effect of "pre-treated" properties (where a home was listed *before* a nearby rehabilitation was completed).

5.B. Hedonic OLS Models and a Quasi Diff-in-Diff Approach

We begin with a straightforward OLS hedonic model for price and time on market (estimated separately). The separate single equation price and liquidity empirical models are based on the estimated equations (1) and (2) below:

$$lnSP = \beta_0 + \sum \beta_i \, RTC_i^{Post} + \sum \beta_j \, RTC_j^{Pre} + \sum \beta_k \, X_k + \varepsilon_P \tag{1}$$

$$lnTOM = \alpha_0 + \sum \alpha_i \, RTC_i^{Post} + \sum \alpha_j \, RTC_j^{Pre} + \sum \beta\alpha_k \, X_k + \varepsilon_T \tag{2}$$

where lnSP is the natural logarithm of selling price and **X** is a vector of property characteristics,[6] spatial fixed effect controls,[7] and time controls.[8] RTC^{post} is the total amount spent on all RTC

[6] Specifically, in the price equation we control for: square feet, age, number of bedrooms, number of bathrooms, acreage, number of levels, number of fireplaces, whether the property is located within a historic district, whether the property has previously completed a RTC project itself, whether the exterior has brick, whether the property is vacant, whether the property has a tenant, whether the property is marketed as having the following - ceramic tile, marble, hardwood floors, a garage. We control for ln(list price) and competition in the time on market equation, and

projects within a concentric circle *i* (which includes, initially, 0.1 mile and 0.25 radius and "donut" respectively) where a given RTC project was completed within 365 days prior to the list date of a given property. That is, if we think of a RTC property as a potential "treatment," then for a given nearby home to be affected, it must be listed *after* the RTC property is rehabilitated (i.e. in the "post period"). The RTC^{Pre} term is the total amount spent on all RTC projects within a concentric circle *j* (which includes, initially, 0.1 mile and 0.25 radius and "donut" respectively) where a given RTC project was completed up to a year after a home was listed. In this case, the home was listed in the "pre period," just prior to RTC projects' completion.

We call this a variant of a diff-in-diff framework because we are essentially comparing a "pre" vs. "post" effect, but the setup is somewhat different from a traditional diff-in-diff analysis for a number of reasons. First, we use a continuous treatment variable, as opposed to more simple dummy variables indicating the presence of a "post RTC" and a "pre RTC," because often the treatment is not binary. It is often the case that homes near RTC properties are near *multiple* RTC properties, and even when it is a single property, there is a lot of variation across individual projects in terms of their cost. That is, RTC projects are not uniform in scope, and we see tremendous variation in the size of historical rehabilitations, so, as a second departure, we do not use a simple count measure either. It is not unreasonable to assume that the expected externality (positive or negative) is likely to vary directly with the size and scope of the project. As a result, this is captured in the total spending RTC variable, which varies with both the number of the projects and the cost of them (note, here we depart from prior methodologies like

ln(time on market) and listing density in the price equation. See below for a description of competition and listing density.

[7] Following a number of studies, we use census blocks was out control for spatial heterogeneity. Census blocks are relatively small neighborhoods (or sub-neighborhoods in many cases), approximating a "block" in dense urban areas and are designed to be relatively homogeneous. We vary our geographic controls later in the paper, showing robustness to alternative approaches to control for spatial heterogeneity.

[8] We use year-by-quarter fixed effects in all specifications.

Coulson and Leichenko (2001), where they use a more simple count measure). Third, the nature of the "pre" vs. "post" period is idiosyncratic, depending on the particular house and when it goes on the market, so we do not have a simple setup where all RTC properties were completed on the same date and we are simply comparing the market before and after, empirically. Thus, our approach allows for essentially a different "pre" and "post" period for *each* home that is listed, rather than having a single pre-post distinction for all at the exact same time. This idiosyncratic approach of quantifying externalities in this way broadly follows a host of externality papers on foreclosures (e.g. Anenburg and Kung (2014)), registered sex offenders (e.g. Pope (2008), Linden and Rockoff (2008), and Wentland, Waller, & Brastow (2014)), and other local (dis)amenities.

The primary reason for the quasi-diff-in-diff approach (as opposed to pure cross-sectional approaches used in prior studies on historical externalities) is the worry that the treatment effect alone (RTC^{post}) will not properly identify the causal effect of the externality. A positive estimed coefficient on our variable of interest, for example, could naively be interpreted as a causal effect of RTC projects on nearby homes, but it is possible that the estimate is reflecting some other aspect of that locale (i.e. unobserved heterogeneity). For example, perhaps the neighborhood is known for having nice neighbors who have always taken excellent care of their properties, which makes that particular location both lovely and ripe for investment in rehabilitating homes. Thus, the more recent externality studies cited above generally use the *timing* of the treatment to sort out the static unobserved heterogeneity (e.g. the general "loveliness" and conscientiousness of the neighbors) from the particular external factor of interest. If both the RTC^{post} and RTC^{pre} are positive, significant, and of similar magnitude, then it is likely the unobserved heterogeneity that explains the *post* phenomena (e.g. the neighbors were lovely both before and after the so-called treatment, explaining the positive effect) is the same unobserved heterogeneity explaining the *pre* phenomena. If the RTC^{pre} estimate is insignificant or the opposite sign, then this is evidence that the treatment effect is properly identified, given that the effect of the *post* variable only coincides with the onset of the actual treatment.

5.C. Simultaneous Equation Approach

The second approach estimates price and liquidity as a simultaneous system of equations, using the same quasi-diff-in-diff methodology that utilizes the timing of the treatment effect. The simultaneous empirical model is motivated by search theory, which implies that both price and time on the market are co-determined by identical factors (Krainer, 2001). This creates econometric problems, since the system of price and liquidity equations implied by search theory is not identified. Early studies using simultaneous price-liquidity approaches rely on *ad hoc* restrictions in order to identify both equations (Sirmans, Turnbull and Benjamin, 1991). In contrast, Zahirovic-Herbert and Turnbull (2008) offer a practical procedure for dealing with the identification problem.

We briefly summarize the approach and its rationale here. Following Turnbull and Dombrow (2006, 2007), we calculate a competition variable (*COMP)* measuring surrounding or neighborhood competition, defined as the distance-weighted number of houses in the surrounding neighborhood that are on the market concurrently with the subject property. Competing houses are those that are within 20% of the same living area as the subject property. This variable captures the surrounding neighborhood market conditions and, following the implications of search theory, would appear in both price and liquidity equations like (1) and (2) as do all of the other house and location characteristics. Using these modified equations as a starting point, Zahirovic-Herbert and Turnbull (2008) show that including time on the market as an explanatory variable in the selling price equation (as implied by search theory) means that the estimated coefficient on the *COMP* variable in the price equation is not the total effect of the number of competing houses on the market at the same time as the subject property, but instead is the effect of the number of competing houses on the market per day of subject market exposure, which is defined as the listing density (*LD*). Imposing this parametric restriction across the equations with *COMP* included yields the simultaneous system

$$lnSP = \beta_0 + \sum \beta_i \, RTC_i^{Post} + \sum \beta_j \, RTC_j^{Pre} + \sum \beta_k \, X_k + \beta_l LD + \varepsilon_P \quad (3)$$

$$lnTOM = \alpha_0 + \sum \alpha_i \, RTC_i^{Post} + \sum \alpha_j \, RTC_j^{Pre} \sum \beta\alpha_k \, X_k + \alpha_l COMP + \varepsilon_{tom} \quad (4)$$

This system of equations is identified and can be estimated without ad hoc rationales about variables to add/subtract from either equation. The search theory that motivates the simultaneous price-liquidity system also implies cross-equation correlation of error terms, in which case 3SLS is asymptotically more efficient than 2SLS (Belsley 1988).

The interpretation of the coefficients on the *LD* and *COMP* variables follows Turnbull and Dombrow (2006). If a greater number of nearby houses on the market only increases the competition among sellers for the same pool of potential buyers then *LD* and *COMP* will have a negative coefficient in the price equation and/or positive coefficient in the liquidity equation, respectively. If, however, more nearby houses on the market also increases buyer search traffic in the neighborhood then the coefficients may be positive in the price and/or negative in the liquidity equations, indicating the presence of shopping externalities from the surrounding properties.[9]

[9] See Turnbull and Dombrow (2006) for a complete discussion of the competition and shopping externality effects. For brevity in our tables, we suppress the coefficient estimates on these variables.

6. Results

6.A. Baseline OLS Results

Our initial results indicate that rehabilitated historical properties (or RTC projects) have a positive impact on nearby properties, where we find a positive association between expenditure on RTC projects and nearby home prices. Table II shows the coefficient estimates for our OLS models (1) and (2) in the previous section (i.e. columns [1]-[3] are estimated price equations and [4]-[6] are time on market equations). For ease of interpretation, we scaled our variables of interest by 10^{-5} (i.e. representing $100,000 increments), given that the median project expenditure within 0.1 mile (conditional on having a project nearby) was $332,293.80 and the mean was $831,078.90. In our first regression, we limited the definition of "nearby projects" to 0.1 mile (approx. 528 ft) to capture the effect of only RTC projects within only a very narrow radius, finding that an additional RTC project of $100,000 would be associated with a 0.32% rise in a nearby home's price. While the unit of analysis is somewhat different, the incremental effect of a typical project in our dataset is substantially larger than the effect in Coulson and Leichenko (2001).[10] That is, an addition of the median RTC expenditure within 0.1 mile (within a single year) corresponds to approximately 1% rise in nearby home prices.[11]

Note that the coefficient estimate on RTC^{Pre} is close to zero and not statistically significant in column [1] (or any other column in Table II for that matter), indicating that there is no positive externality effect that exists *prior* to the nearby RTC project's completion. If an externality effect did exist prior to the treatment "going into effect," we would suspect that some

[10] The primary effect is interpreted as an additional historical property in a listed home's same census tract.
[11] This estimate is obtained simply by multiplying to coefficient by 3.32. Another common interpretation would be an increase in a standard deviation of RTC expenditure (conditional on having expenditure), which is approximately $1.4 million. An increase of this size translates into nearly 4.5% appreciation in nearby home prices.

static unobserved heterogeneity of the kind we discussed in the methodology section could be at play. However, this null effect provides evidence that our RTC^{Post} effect is properly identified, given that the onset of the effect occurs when the "treatment" actually occurs (i.e. after the rehabilitation project is complete). Also note that controlling for this potential effect is not trivial, given the results in Appendix Table A, where we have a setup more similar to Coulson and Leichenko (2001) using only a count measure in the first and third columns. In our data, we find a positive effect like Coulson and Leichenko (2001) when we estimate the cross-sectional effect with a count measure; but, when we incorporate the *pre* term into the regression model, the coefficient is substantially smaller and is no longer statistically significant (at least when errors are clustered by census block), illustrating some of limitations of the early approaches in this literature.

When we expand the definition of "nearby" to estimate the impact of the externality at further distances, we find a decaying effect as far as 0.25 miles away. Again, note that we are controlling for relatively small geographic areas, such that we have "within census block" estimates, so much of the location-specific value will be "soaked up" by these parameters. We find that the external impact of RTC expenditures are substantially smaller when they are a little further away (i.e. within the 0.1-0.25 mile donut). Also note that the size of the RTC^{Pre} coefficient is only slightly smaller than the RTC^{Post} effect, indicating that much of the effect we observe in this further distance could be due to static unobserved heterogeneity that existed prior to the treatment, giving us little confidence that the *post* quarter mile estimate is properly identified as positive. Overall, the smaller effect, if any, as distance from the RTC project goes up, is consistent with theory.

To this point, we have only examined a standardized, short term effect of RTC projects on the housing market, looking at the immediate impact of these projects on the nearby market. We have limited the investigation to projects within a year for easier identification of a "pre" and "post" effect of an identical time period. Column [3] tests the longer term effect of nearby RTC projects by incorporating a RTC^{Post} variable that measures total RTC project expenditure beyond a single year (i.e. all-time – since 1997). Beyond measurement error concerns by having potential different treatment time periods (which are somewhat allayed by the use of year-by-quarter fixed effects), a main concern with measuring the externality this way is that a property rehabbed 10 years ago may have a fundamentally different effect than one rehabbed last month (whereas one rehabbed 10 months ago is likely to have a much more similar effect as one month ago). That is, the externality effect is like to depreciate as the RTC project itself depreciates. Correspondingly, we find the long term effect of RTC project expenditures on nearby properties is substantially smaller than the within-year effect (approximately ¼ of the effect), and falling just outside the 10% significance level. Based on these initial results, there is little evidence that RTC projects exhibit a long term effect on the surrounding housing market, but this could be due, at least in part, to measurement error and the challenge of estimating long term effects empirically.[12]

Columns [4]-[6] in Table II show initial evidence of a small or limited external effect of RTC projects on the marketing duration of nearby properties. Specifically, the effect on time on market is positive, but not significant at conventional levels of statistical significance in the OLS

[12] There is also the additional issue of determining the appropriate "pre" period for the longer run specification, whereas the year "pre" and year "post" periods are appropriately symmetric with similar summary statistics for the magnitude of both variables.

estimates.[13] However, one key concern about the OLS estimates is simultaneity bias resulting from estimating these equations individually rather than in a simultaneous system. We will return to this point when we discuss the 3SLS results in section 6.D.

Most of the control variables are suppressed from Table II (and the remaining tables) for brevity, but we included the dummy variable for whether the home resides within an officially designated historic district in our tables for comparability with other studies. We find that the own-home effect of a historic district is positive, even after controlling for fine spatial fixed effects. Our measured effects in Table II for own-home historical district valuation are very similar to Coulson and Leichenko (2001), despite the fact that we are quantifying an effect in a different geographical area, potentially reflecting comparability and some generalizability of this particular estimate.

6.B. Heterogeneous Effects – Historic District Rehabs vs. Non-Historic District Rehabs

A natural question extending from the analysis to this point is whether a rehabilitated historic home has a different effect within a historic district than it would outside a historic district. There are at least two hypotheses leading in opposite directions regarding this question. A historic district may be an area where RTC projects are highly valued, given the "cache" that comes from living in such a district and the high estimated own-home effect of living within this district (perhaps call this a "history-lover-neighborhood hypothesis"). A second hypothesis is that RTC projects are so common in these districts that there is little if any external effect (perhaps call it a "dime-a-dozen hypothesis"), whereas outside a historical district, a rehabilitated historic property may be more unique and garner more positive attention from (potential)

[13] When we estimate the RTC project externality on liquidity using a parametric (Weibull) hazard model in Appendix Table B, we find results on par with the OLS results. Specifically, we find consistent, small positive effects on time on market in each specification, but none are significant at conventional levels of statistical significance.

neighbors. There are a number of other plausible explanations for heterogeneous effects across districts and non-districts, but we include these only for illustrative purposes.

Table III provides evidence of the "dime-a-dozen hypothesis," where we find a strong positive link between RTC project expenditure and nearby home prices for homes *not* in historic districts, but little effect *within* a historic district. Specifically, column [1] shows that a $100,000 project within 0.1 mile will increase a nearby home's price by approx. 0.5%, whereas a RTC project of the same magnitude would only result in an increase of 0.007% (and a linear combination test reveals that this effect is not statistically significant). While the own-home effect of living within a historic district is still large, the marginal rehabilitated property within the district conveys little, if any, additional value to the neighborhood (not already capitalized into the large, positive historic district effect). The time on market effect is similar; although, while statistically significant, it does not appear to be economically significant for homes in non-historic districts. That is, homes stay on the market for about a day longer for each $100,000 project located within 0.1 mile of a particular home.

6.C. Robustness across Alternative Specifications

We explore alternative specifications that address different questions that may stem from the analysis to this point. In Table III, we incorporate a count measure of RTC projects within 0.1 mile, noting that this completely changes the interpretation of the coefficients of interest. The expenditure measure implicitly contains the number of projects by itself, so the interpretation of our RTC^{Post} variable of interest becomes the effect of additional RTC project expenditure *holding the number of projects constant*, or, simply the effect of "larger, more costly projects." We find that the coefficient estimate on our variable of interest has not changed much, given this specification, suggesting that there do not appear to be diminishing returns to larger projects or some diminished effect. The coefficient estimate on the number of projects, holding constant the level of total spending, is not statistically significant, suggesting that the RTC project spending is largely invariant to whether a total expenditure is made up of many, smaller projects vs. few, larger projects.

In Table IV, we explore whether the type of control of spatial heterogeneity matters. This is an important concern, given that we are trying to estimate an externality that is spatial in nature. That is, we may be concerned that RTC projects are initiated by people in wealthier places, for example, and the positive effect on home prices is really reflecting some underlying spatial condition of this nature. The first and fourth columns contain the initial specifications from Table II, reproduced here for ease of access. The proceeding two columns show stratifications where we limit the sample to homes within two miles and one mile of a ("treated") rehabilitated historic property, respectively. The one mile specification does not include census block fixed effect, given that the counterfactual properties are all just slightly further away from RTC projects. The price effect is somewhat smaller with these sample stratifications, but the external effect of RTC project expenditure remains strongly positive on nearby home prices. The time on market effect remain small, and still not statistically significant in these specifications. Overall, the results remain consistent across a variety of alternative specifications, including numerous untabulated results altering the spatial controls.

6.D. Robustness across Methodological Approaches: Simultaneous Systems

When we estimate the price and liquidity equations in a simultaneous system (3SLS), we find a similar price spillover effect from RTC project expenditures, as well as a positive time on market effect. Table V shows the results of three estimated systems, with the key differentiating factor among them being the addition of wider concentric distance bands that measure the effect further out. In all models, we restrict the sample to properties within two miles of a rehabilitated historical property, analogous to the second specification in the previous table. In the first specification, a $100,000 rise in RTC project expenditure corresponds to approximately 0.23% price appreciation of nearby homes, approximately the same price effect as the analogous specification in Table IV. However, when estimated simultaneously, the time on market effect of an additional $100,000 spent on nearby RTC projects results in a 9% increase in time on market. This is both statistically and economically significant, given that a moderate rise in RTC expenditure (of $400,000) would lead to approximately a month longer time on market for a nearby property (within 0.1 mile). Moreover, the effect of RTC expenditure in the "pre" period is near zero and is not statistically significant, providing evidence that the "treatment" is properly identified as causal. The effects diminish somewhat as the measured externality expands its radius, but the sign and significance remain robust for the 0.1 mile radius. The somewhat longer time on market effect could reflect the fact that historical areas could be more niche markets, suited for individuals with high preferences for these products (analogous to higher-end car markets, whose dealer lots generally experience lower volume on a given day).

7. Conclusion

We investigate whether there is evidence that rehabilitated historic homes have a quantifiable external impact on the nearby housing market using unique data from Virginia, finding consistent evidence of a robust price externality effect from RTC projects, consistent with theory; and, we find more limited evidence of RTC projects having a small impact on the liquidity of nearby homes. Consistent with prior studies, we find a substantial own-home premium for properties selling in historic districts; but, unique to this study, we find that RTC expenditure in non-historic district have much larger externality effects when compared to the little, if any, external effect of RTC expenditure in historic districts. Our results are robust to numerous alternative specifications and hedonic methodologies commonly used in this literature. Moreover, unlike previous studies that examine historical properties and the housing market, our difference-in-difference approach (or variant thereof) provides evidence that our results are properly identified as causal, as we utilize the timing of the onset of the positive externality as our identification strategy. This is a key contribution of our paper to a growing literature on the analysis of the effects of historic properties. Broadly, our study underscores the importance of local amenities in hedonic valuation in the housing market, where investment in quality improvements not only impact the property that makes the investment directly, but also nearby properties indirectly. Given that real estate market as an industry comprises 13% of the U.S. economy,[14] a deeper understanding of how local amenities (or disamenities) influence price dynamics and the valuation of housing may also improve the accuracy of measurement of a key industry of our economy.

[14] U.S. Bureau of Economic Analysis – GDP by Industry / VA, GO, II, 2014

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Tables

Table I
Summary Statistics

Panel A: Post-Culled Sample, Sold Properties	Mean	Std. Dev.
Sale Price ($)	244,232.20	129,387.80
Time on Market (days)	50.80	59.35
List Price ($)	248,018.90	132,539.70
RTC Project within 0.1 Mile (dummy)	0.02	0.14
RTC Project within 0.25 Mile (dummy)	0.04	0.18
RTC Project within 0.50 Mile (dummy)	0.06	0.23
Num. RTCs with 0.1 Mile (within past year)	0.01	0.15
Num. RTCs with 0.1 Mile (upcoming year)	0.01	0.16
Num. RTCs with 0.1 Mile (prior to past year)	0.06	0.58
Within Historical District (dummy)	0.01	0.10
Bedrooms	3.57	0.75
Bathrooms	2.04	0.72
Square Feet	2,081.87	837.43
Acreage	0.75	2.27
Age (in years)	24.82	28.52
Number of Levels	1.85	0.65
Brick (dummy)	0.23	0.42
Ceramic (dummy)	0.09	0.28
Marble (dummy)	0.02	0.14
Hardwood (dummy)	0.23	0.42
Number of fireplaces	0.76	0.73
Garage (dummy)	0.53	0.50
Vacant (dummy)	0.38	0.48
Tenant (dummy)	0.02	0.13

Panel B – Conditional Summary Statistics and Counts	*Median (if > 0)*	*Mean (if > 0)*	*Std. Dev. (if >0)*	*Count (if >0)*
Total RTC-Qualified Expenditures within 0.1 mile within the last year *($ in 10^{-5})*	3.32	8.54	14.86	995
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year *($ in 10^{-5})*	3.21	9.60	32.75	1,073
Total RTC-Qualified Expenditures within 0.25 mile within the last year *($ in 10^{-5})*	6.22	17.48	28.12	2,626
Total RTC-Qualified Expenditures within 0.25 mile for the upcoming year *($ in 10^{-5})*	7.19	19.42	32.40	2,778
Total RTC-Qualified Expenditures within 0.1 mile beyond 1-year ago (*$ in 10^{-5}*)	5.62	15.28	25.65	1,969

Table II
The Effect of Historical Rehab Property Spending on Nearby Home Prices and Liquidity: OLS Specifications

	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]	[5]	[6]
Total RTC-Qualified Expenditures within 0.1 mile within the last year (Treatment) *($ in 10^{-5})*	0.0032*** (4.57)	0.0023*** (3.56)	0.0029*** (4.25)	0.0020 (1.54)	0.0018 (1.44)	0.0017 (1.34)
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*	0.0005 (0.77)	0.0002 (0.39)	0.0004 (0.72)	0.0004 (0.74)	0.0003 (0.62)	0.0003 (0.66)
Total RTC-Qualified Expenditures within 0.25 mile within the last year (Treatment) *($ in 10^{-5})*		0.0015*** (5.38)			0.0009* (1.84)	
Total RTC-Qualified Expenditures within 0.25 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*		0.0013*** (4.41)			-0.0001 (-0.24)	
Total RTC-Qualified Expenditures within 0.1 mile beyond 1-year ago (Treatment) *($ in 10^{-5})*			0.0007 (1.61)			0.0006 (1.07)
Within Historical District	0.1842*** (11.16)	0.1501*** (9.07)	0.1763*** (10.14)	-0.0055 (-0.14)	-0.0146 (-0.39)	-0.0122 (-0.29)
Property Characteristics	✓	✓	✓	✓	✓	✓
Census Block F.E.	✓	✓	✓	✓	✓	✓
Year-by-Quarter F.E.	✓	✓	✓	✓	✓	✓
Observations	112,349	112,349	112,349	198,624	198,624	198,624
R-squared	0.7561	0.7568	0.7561	0.1624	0.1624	0.1624

Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Table III
The Effect of Historical Rehab Property Spending on a Nearby Home Price and Liquidity: Heterogeneous Effects and Alternative Specifications

	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]
Total RTC-Qualified Expenditures within 0.1 mile within the last year (Treatment) *($ in 10^{-5})*	0.0048*** (5.15)	0.0031*** (4.21)	0.0056*** (3.13)	-0.0003 (-0.20)
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*	0.0006 (0.77)	0.0000 (0.11)	0.0001 (0.30)	-0.0008 (-1.23)
Within Historical District (Dummy)	0.1972*** (11.47)		0.0064 (0.14)	
RTC^{Post} * Historical District	-0.0041*** (-3.08)		-0.0084*** (-2.86)	
RTC^{Pre} * Historical District	-0.0017 (-1.37)		0.0024 (0.77)	
Number of RTC Projects within 0.1 mile within the last year		-0.0074 (-0.76)		0.0288 (1.59)
Number of RTC Projects within 0.1 mile for the upcoming year		0.0331*** (3.43)		0.0733*** (3.79)
Linear Combination Test (P-value)	0.509		0.194	
Property Characteristics	✓	✓	✓	✓
Census Block Fixed Effects	✓	✓	✓	✓
Quarterly Fixed Effects	✓	✓	✓	✓
Observations	112,349	112,349	198,624	198,624
R-squared	0.7561	0.7562	0.1624	0.1625

Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Table IV
The Effect of Historical Rehab Property Spending on a Nearby Home Price and Liquidity: Robustness across Spatial Controls

	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)	OLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]	[5]	[6]
Total RTC-Qualified Expenditures within 0.1 mile within the last year (Treatment) *($ in 10^{-5})*	0.0032*** (4.57)	0.0023*** (3.49)	0.0019*** (3.03)	0.0020 (1.54)	0.0012 (1.03)	0.0016 (1.43)
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*	0.0005 (0.77)	0.0003 (0.50)	-0.0001 (-0.20)	0.0004 (0.74)	-0.0005 (-0.89)	-0.0007 (-1.29)
Within Historical District	0.1842*** (11.16)	0.1353*** (8.24)	0.1041*** (8.54)	-0.0055 (-0.14)	-0.1166*** (-3.70)	-0.0626** (-2.15)
Property Characteristics	✓	✓	✓	✓	✓	✓
Census Block F.E.	✓	✓	✓	✓	✓	✓
Year-by-Quarter F.E.	✓	✓	✓	✓	✓	✓
Observations	112,349	27,004	14,550	198,624	51,387	29,054
R-squared	0.7561	0.6192	0.6078	0.1624	0.2076	0.2101

Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Table V
The Effect of Historical Rehab Property Spending on a Nearby Home Price and Liquidity: 3SLS Specifications

	3SLS Dependent Variable: ln(Price)	3SLS Dependent Variable: ln(TOM)	3SLS Dependent Variable: ln(Price)	3SLS Dependent Variable: ln(TOM)	3SLS Dependent Variable: ln(Price)	3SLS Dependent Variable: ln(TOM)
	[1]	[2]	[3]	[4]	[5]	[6]
Total RTC-Qualified Expenditures within 0.1 mile within the last year (Treatment) *($ in 10^{-5})*	0.0023*** (4.52)	0.0910*** (5.73)	0.0018*** (3.61)	0.0733*** (4.59)	0.0008* (1.65)	0.0365** (2.11)
Total RTC-Qualified Expenditures within 0.25 mile within the last year (Treatment) *($ in 10^{-5})*			0.0010*** (6.09)	0.0413*** (7.46)	0.0004** (2.55)	0.0188*** (3.14)
Total RTC-Qualified Expenditures within 0.5 mile within the last year (Treatment) *($ in 10^{-5})*					0.0003*** (4.22)	0.0103*** (4.66)
Total RTC-Qualified Expenditures within 1 mile within the last year (Treatment) *($ in 10^{-5})*					0.0001*** (3.98)	0.0043*** (4.65)
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*	0.0002 (0.80)	0.0102 (1.14)	0.0000 (0.08)	0.0019 (0.21)	-0.0007** (-2.34)	-0.0274*** (-2.71)
Total RTC-Qualified Expenditures within 0.25 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*			0.0008*** (5.45)	0.0317*** (6.80)	0.0003* (1.79)	0.0117** (2.30)
Total RTC-Qualified Expenditures within 0.5 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*					0.0003*** (3.61)	0.0105*** (4.40)
Total RTC-Qualified Expenditures within 1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*					0.0001*** (5.45)	0.0057*** (6.52)
Property Characteristics	✓	✓	✓	✓	✓	✓
Census Block F.E.	✓	✓	✓	✓	✓	✓
Year-by-Quarter F.E.	✓	✓	✓	✓	✓	✓
Observations	27,004	27,004	27,004	27,004	27,004	27,004
R-squared	0.6469	-67.2144	0.6480	-67.2684	0.6506	-70.2514

Z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix

Appendix – Table A
The Effect of an Additional Historical Rehab Property on a Nearby Home's Price (OLS): Count Method Only

	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)	OLS Dependent Variable: ln(Price)
	[1]	[2]	[3]	[4]
Number RTCs within 0.1 mile within the last year (Treatment)	0.0206* (1.95)	0.0098 (1.06)		
Number of RTC Projects within 0.1 mile (Treatment)			0.0082* (1.88)	0.0048 (1.15)
Number RTCs within 0.1 mile for the upcoming year ("Pre-treatment")		0.0325*** (3.44)		0.0298*** (3.04)
Within Historical District (Dummy)	0.1837*** (11.35)	0.1788*** (11.05)	0.1695*** (8.66)	0.1701*** (8.68)
Property Characteristics	✓	✓	✓	✓
Census Block Fixed Effects	✓	✓	✓	✓
Quarterly Fixed Effects	✓	✓	✓	✓
Observations	112,349	112,349	112,349	112,349
R-squared	0.7560	0.7561	0.7560	0.7561

Robust t-statistics in parentheses (Errors Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Appendix – Table B
The Effect of Historical Rehab Property Spending on a Nearby Home Liquidity: Duration Models

	Weibull Dependent Variable: ln(TOM)	Weibull Dependent Variable: ln(TOM)	Weibull Dependent Variable: ln(TOM)	Weibull Dependent Variable: SOLD	Weibull Dependent Variable: SOLD	Weibull Dependent Variable: SOLD
	[1]	[2]	[3]	[4]	[5]	[6]
	Accelerated Failure-Time Form			*Log Relative Hazard Form*		
Total RTC-Qualified Expenditures within 0.1 mile within the last year (Treatment) *($ in 10^{-5})*	0.0036 (1.24)	0.0026 (0.92)	0.0002 (0.09)	-0.0028 (-1.24)	-0.0020 (-0.92)	-0.0002 (-0.09)
Total RTC-Qualified Expenditures within 0.25 mile within the last year (Treatment) *($ in 10^{-5})*		0.0017* (1.73)	-0.0002 (-0.20)		-0.0013* (-1.73)	0.0002 (0.20)
Total RTC-Qualified Expenditures within 0.5 mile within the last year (Treatment) *($ in 10^{-5})*			0.0001 (0.16)			-0.0000 (-0.16)
Total RTC-Qualified Expenditures within 1 mile within the last year (Treatment) *($ in 10^{-5})*			0.0003* (1.84)			-0.0003* (-1.84)
Total RTC-Qualified Expenditures within 0.1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*	0.0005 (0.42)	0.0002 (0.17)	-0.0019*** (-2.85)	-0.0004 (-0.42)	-0.0001 (-0.17)	0.0014*** (2.86)
Total RTC-Qualified Expenditures within 0.25 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*		0.0015* (1.70)	-0.0003 (-0.38)		-0.0011* (-1.71)	0.0002 (0.38)
Total RTC-Qualified Expenditures within 0.5 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*			0.0002 (0.51)			-0.0002 (-0.51)
Total RTC-Qualified Expenditures within 1 mile for the upcoming year ("Pre-treatment") *($ in 10^{-5})*			0.0006*** (3.53)			-0.0005*** (-3.57)
Property Characteristics	✓	✓	✓	✓	✓	✓
Census Block F.E.	✓	✓	✓	✓	✓	✓
Year-by-Quarter F.E.	✓	✓	✓	✓	✓	✓
Observations	198,623	198,623	198,623	198,623	198,623	198,623

Robust Z-statistics in parentheses (Clustered by Census Block)
*** p<0.01, ** p<0.05, * p<0.10

Figure 1:

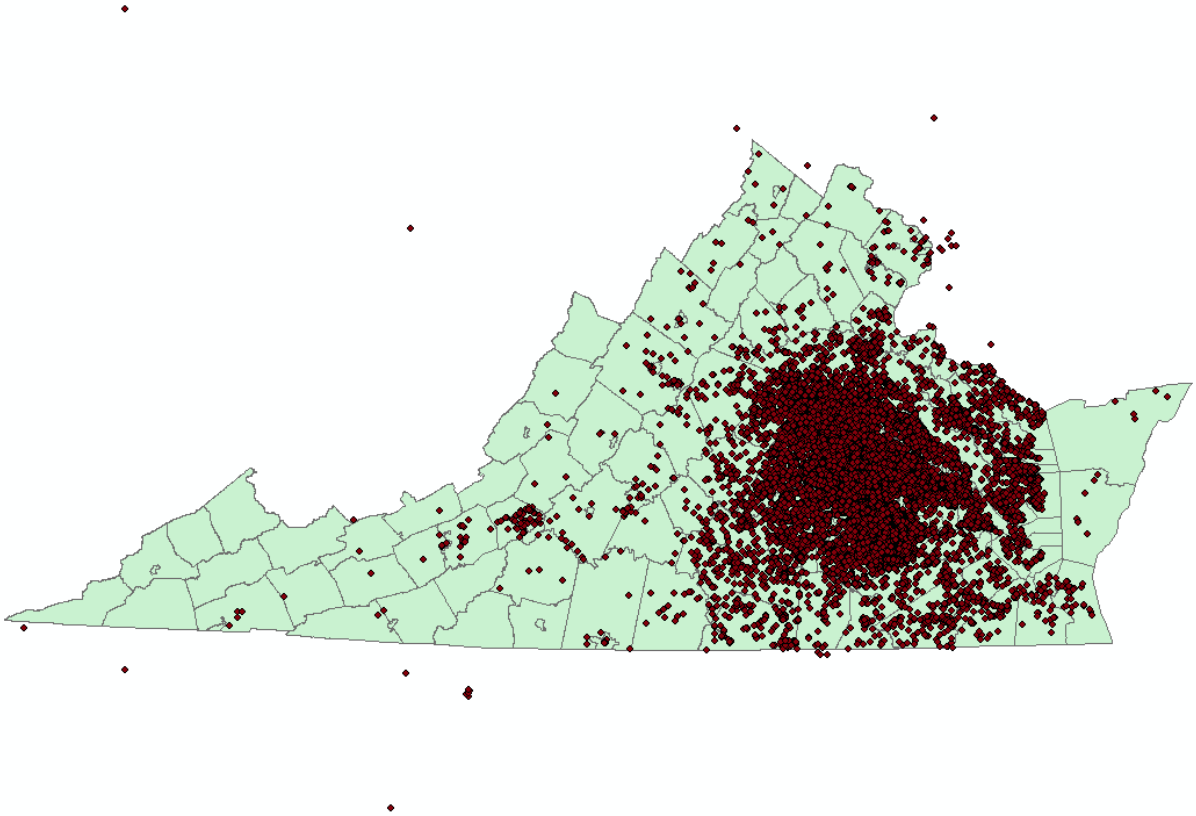


Figure 2: Historic districts in City of Richmond, Virginia

Figure 3: Richmond Virginia and surrounding counties

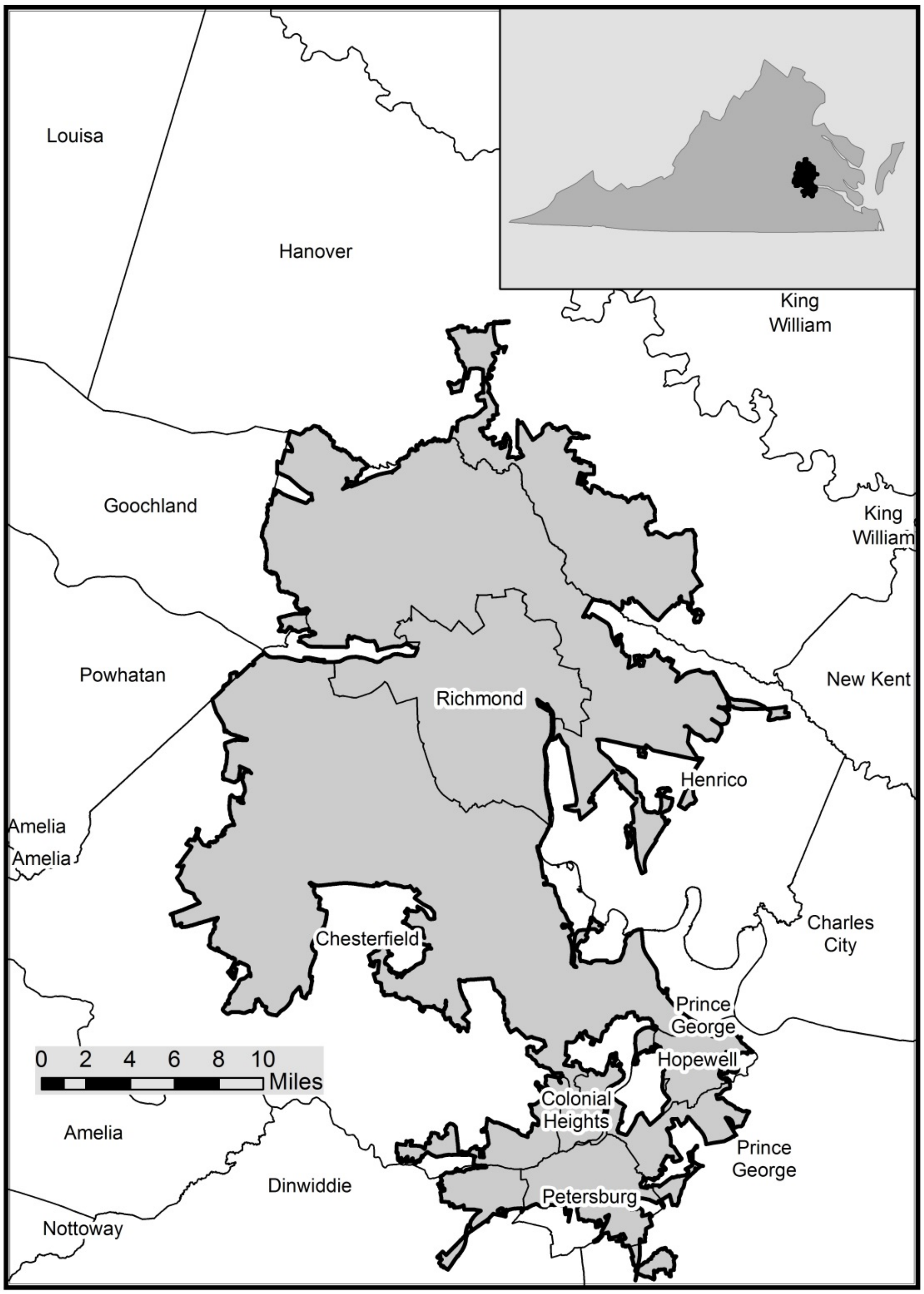


Figure 4: Jackson Ward Historic District

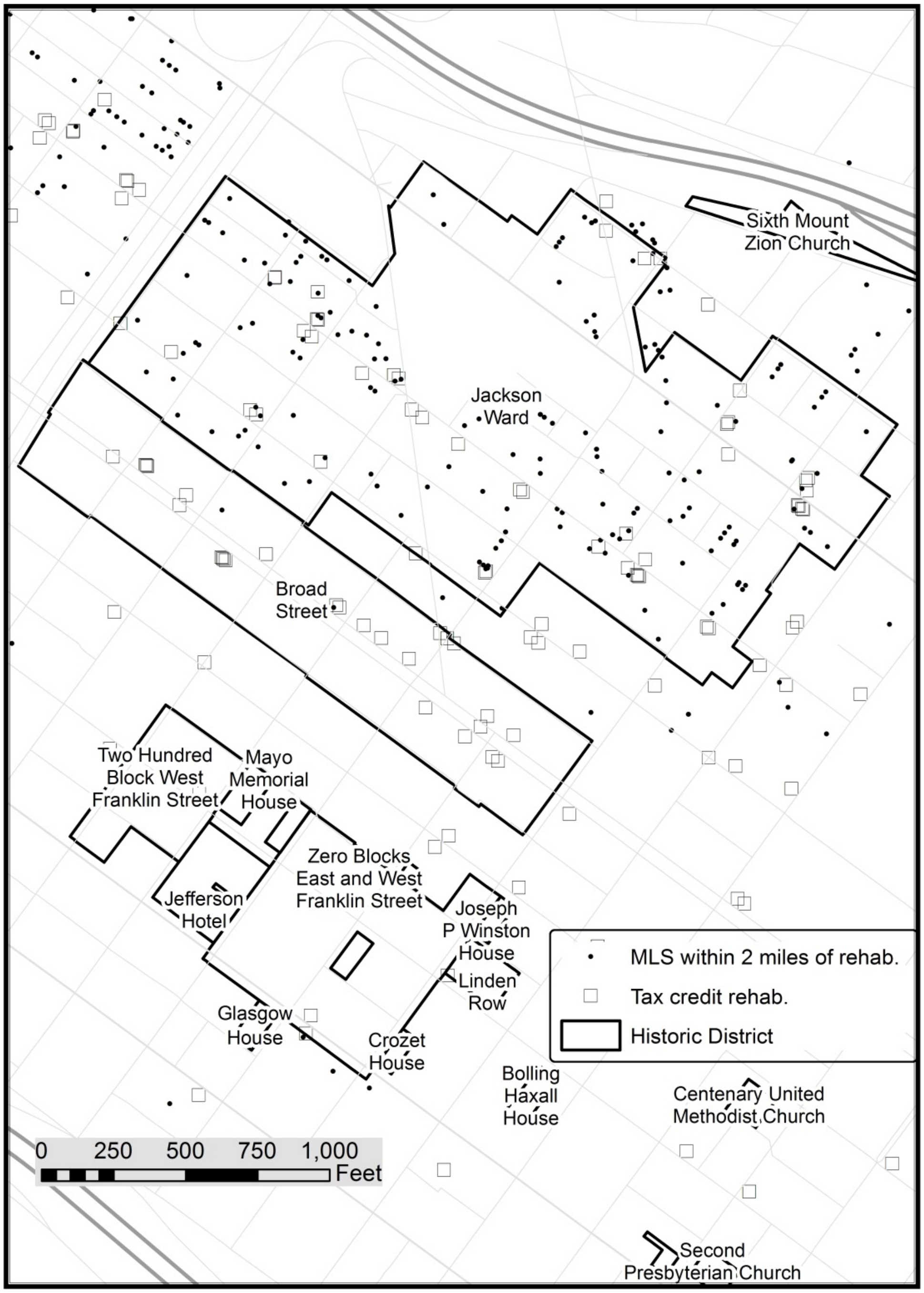
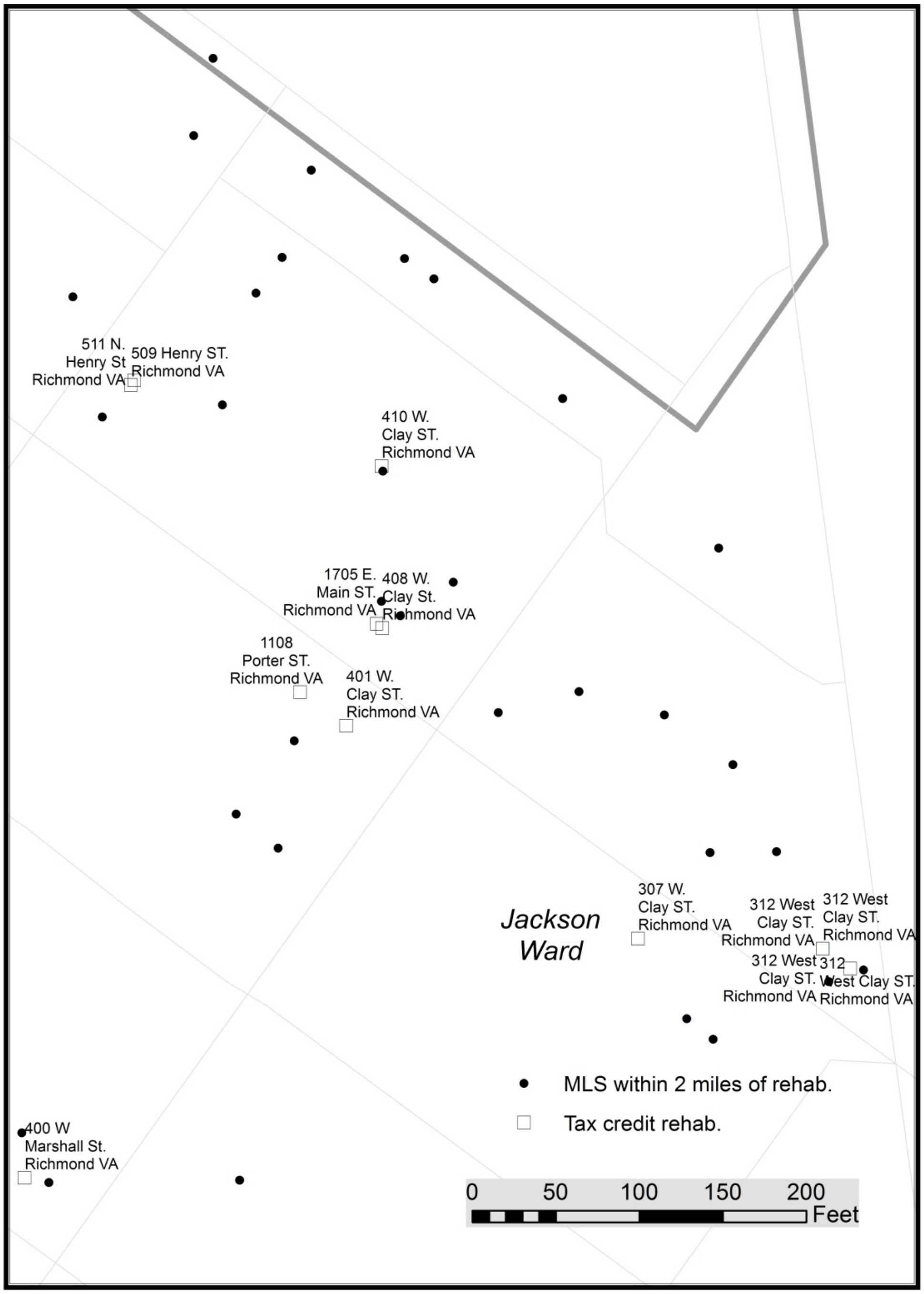


Figure 5:


511 N. Henry St Richmond VA
509 Henry ST. Richmond VA
410 W. Clay ST. Richmond VA
1705 E. Main ST. Richmond VA
408 W. Clay St. Richmond VA
1108 Porter ST. Richmond VA
401 W. Clay ST. Richmond VA
Jackson Ward
307 W. Clay ST. Richmond VA
312 West Clay ST. Richmond VA
312 West Clay ST. Richmond VA
312 West Clay ST. Richmond VA
312 West Clay ST. Richmond VA
MLS within 2 miles of rehab.
Tax credit rehab.
400 W Marshall St. Richmond VA
0 50 100 150 200
Feet